February 1946

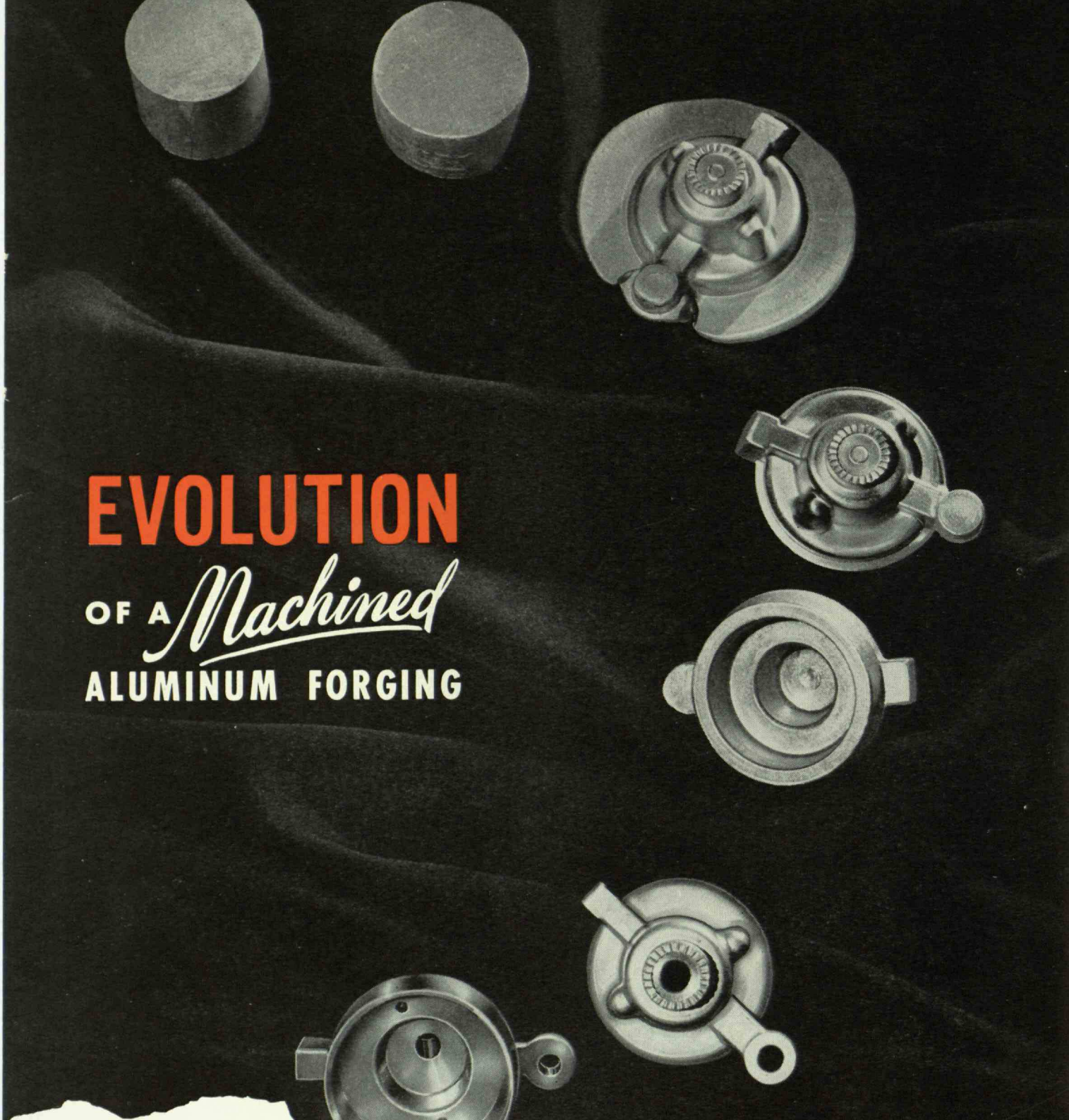
TECHNOLOGY REVIEW

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review
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EVOLUTION OF A *Machined* ALUMINUM FORGING

THE

HARVEY

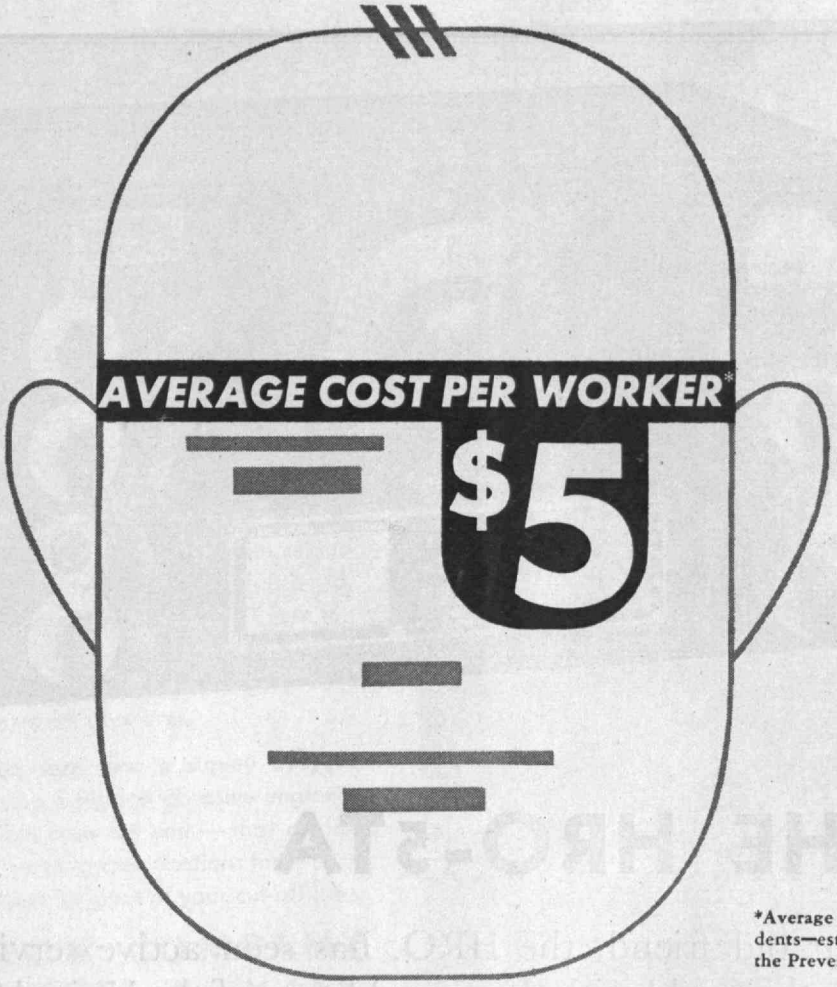
METAL CORPORATION

HAROLD B. HARVEY '05 • *Engineers & Manufacturers* • SHERRY O'BRIEN '17

74th STREET and ASHLAND AVENUE • CHICAGO 36, ILLINOIS

FORGINGS IN ALUMINUM • BRASS • BRONZE • COPPER • MAGNESIUM • MONEL • ALLOYS

MACHINING FACILITIES



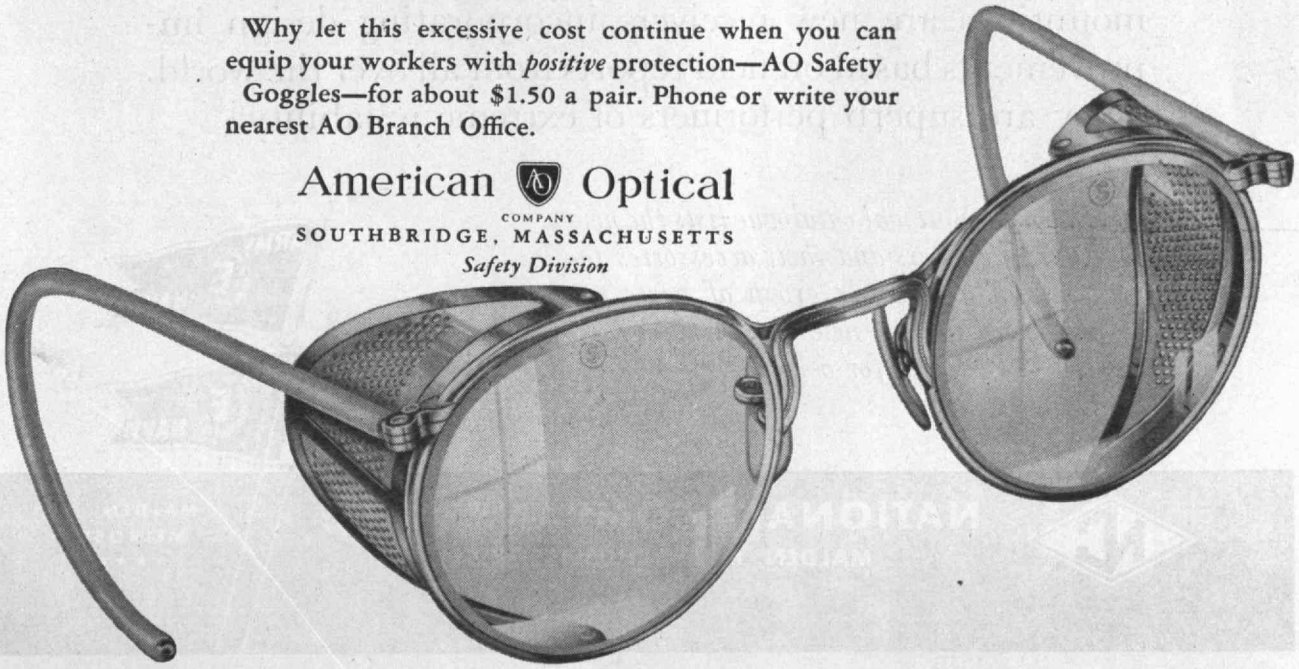
*Average annual cost for all eye accidents—estimated by the Society for the Prevention of Blindness.

It's Cheaper Not to Take Chances

AO SAFETY GOGGLES SAFEGUARD THE EYES OF INDUSTRY

Why let this excessive cost continue when you can equip your workers with *positive* protection—AO Safety Goggles—for about $1.50 a pair. Phone or write your nearest AO Branch Office.

American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS
Safety Division



THE TECHNOLOGY REVIEW, February, 1946. Vol. XLVIII, No. 4. Published monthly from November to July inclusive at 10 Ferry Street, Concord, N. H Publication date: twenty-seventh of the month preceding date of issue. Annual subscription $3.50; Canadian and Foreign subscription $4.00. Entered as second-class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879.



THE HRO-5TA

Your old friend, the HRO, has seen active service all over the world with the armed forces of the United States and our allies. Much has been learned, and the HRO has emerged from its trial by fire an even better receiver than the superb receiver you knew before the war.

The HRO-5TA (table model) and the HRO-5RA (rack mounting) are new receivers incorporating design improvements based on field reports from all over the world. They are superb performers of extreme reliability.

» *The new National catalogue lists the new HRO-5A receivers and their accessories together with a versatile group of parts you will need in your new rig. Ask your dealer for a copy.*



NATIONAL COMPANY, INC.
MALDEN, MASSACHUSETTS, U.S.A.

MALDEN
MELROSE
★★★★

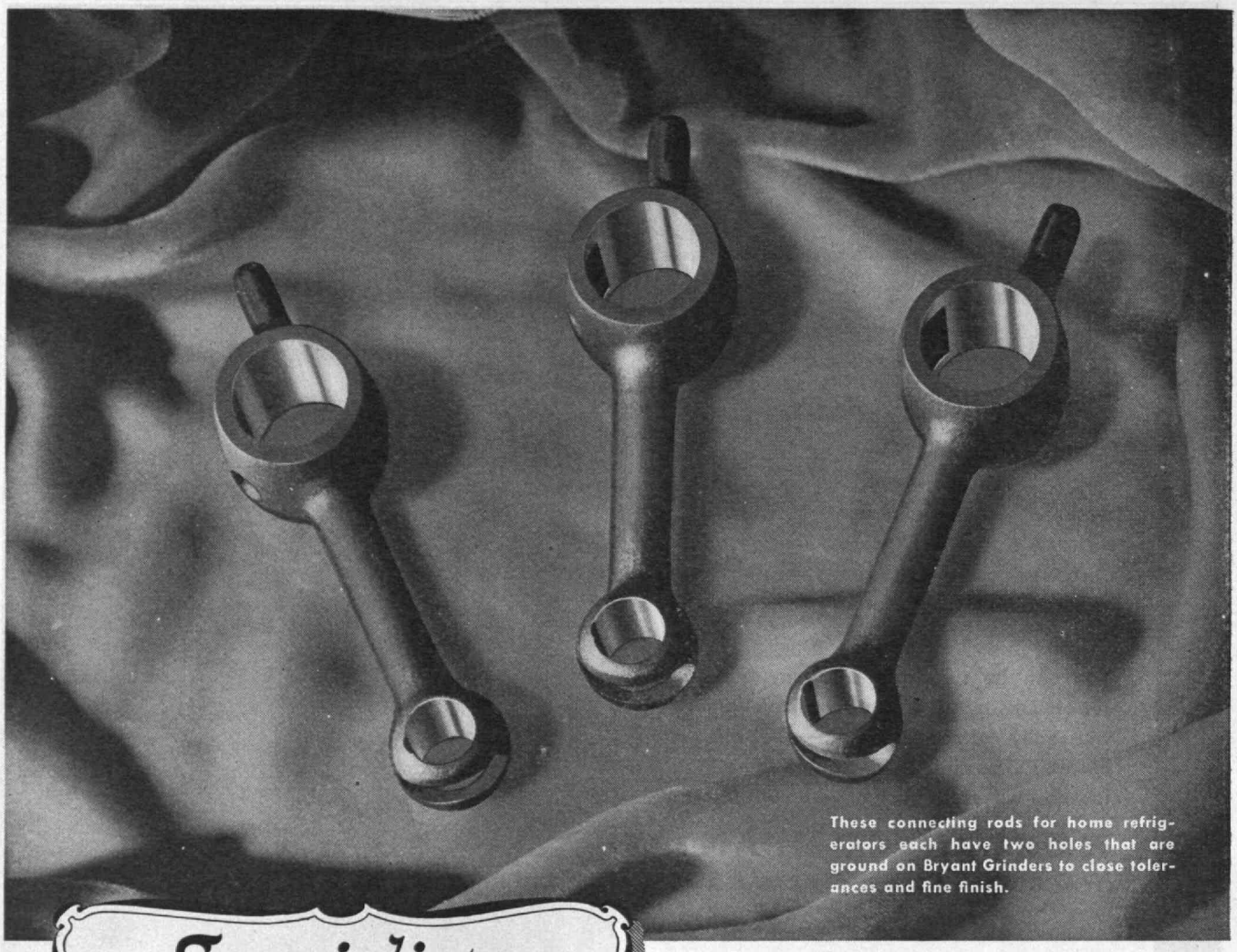
Are You Using Cut-off Wheels *that Really Fit Your Jobs?*

WHEN a Norton abrasive engineer tackles your cut-off jobs he's not limited to one special type of wheel. He has a *complete line* to choose from — over 50,000 possible specifications. For example, he has several varieties of resinoid bond, both natural and synthetic rubber bond, and shellac bond. He has Alundum, 57 Alundum and Crystolon abrasives. And in each abrasive and bond he has a wide range of grit sizes, grades (hardnesses) and structures.

You can be sure that a survey of your cut-off jobs by a Norton abrasive engineer will really cut costs for you — that among his 50,000 possible specifications there's the low cost wheel for each of your cut-off jobs.

NORTON COMPANY
WORCESTER 6, MASS.
Behr-Manning, Troy, N. Y. is a Norton Division





These connecting rods for home refrigerators each have two holes that are ground on Bryant Grinders to close tolerances and fine finish.

Specialists in Forged Steel Jewelry

No, we don't sell it; we don't make it, but we do build internal grinding machines that make it. The three connecting rods for home refrigerators, shown above, are typical examples of the type of work that is ground on Bryant Internal Grinders. They are truly jewel-like in their finish, but that is not enough—to be sure, Bryant Grinders produce metal parts that have surfaces finished correctly to millionths of an inch, when desired, but Bryant machines also produce these same parts with holes that are truly round and straight. These are basic elements that Bryant insists upon to assure Bryant users that their parts and products will last for years without mechanical failure.

WE KNOW YOUR PROBLEM IS DIFFERENT . . .

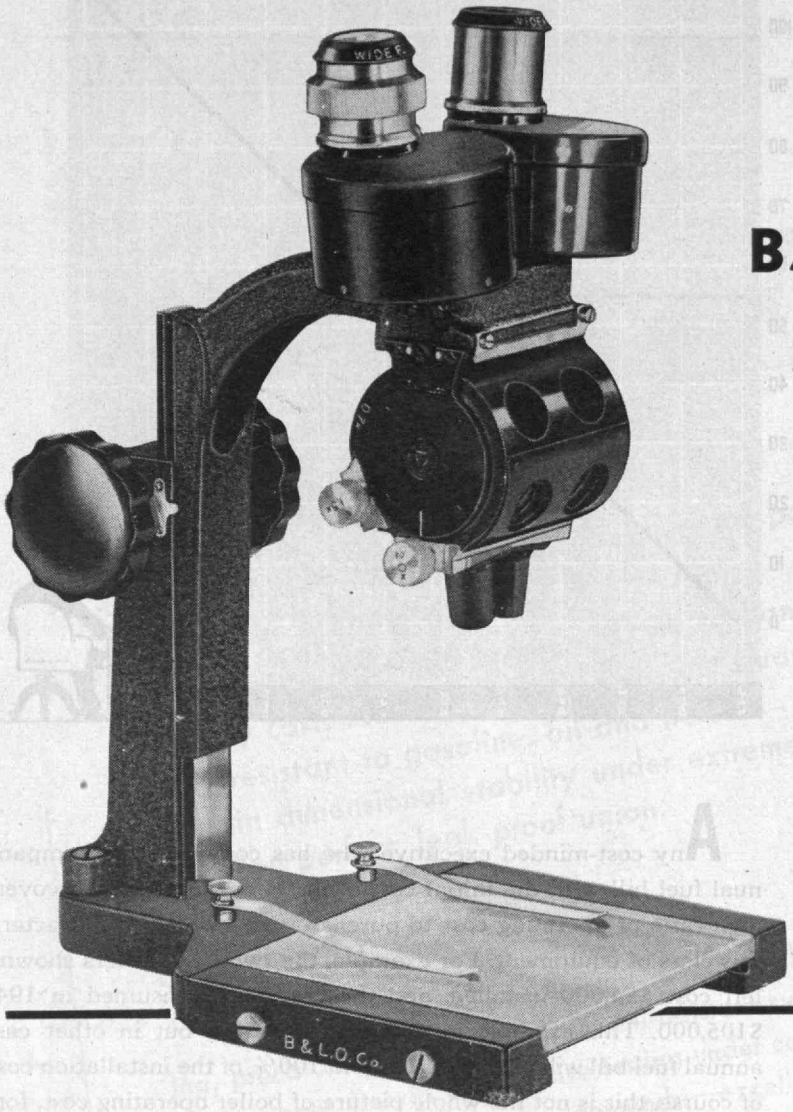
. . . practically every internal grinding problem is different. But when you require extreme accuracy or high production, *or both,* your first step should be to study your problem with a man who makes it his business to solve them. Your first step should be to—

Send for the Man from Bryant!

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.



BAUSCH & LOMB STEREOSCOPIC WIDE FIELD MICROSCOPE

MODEL AKW

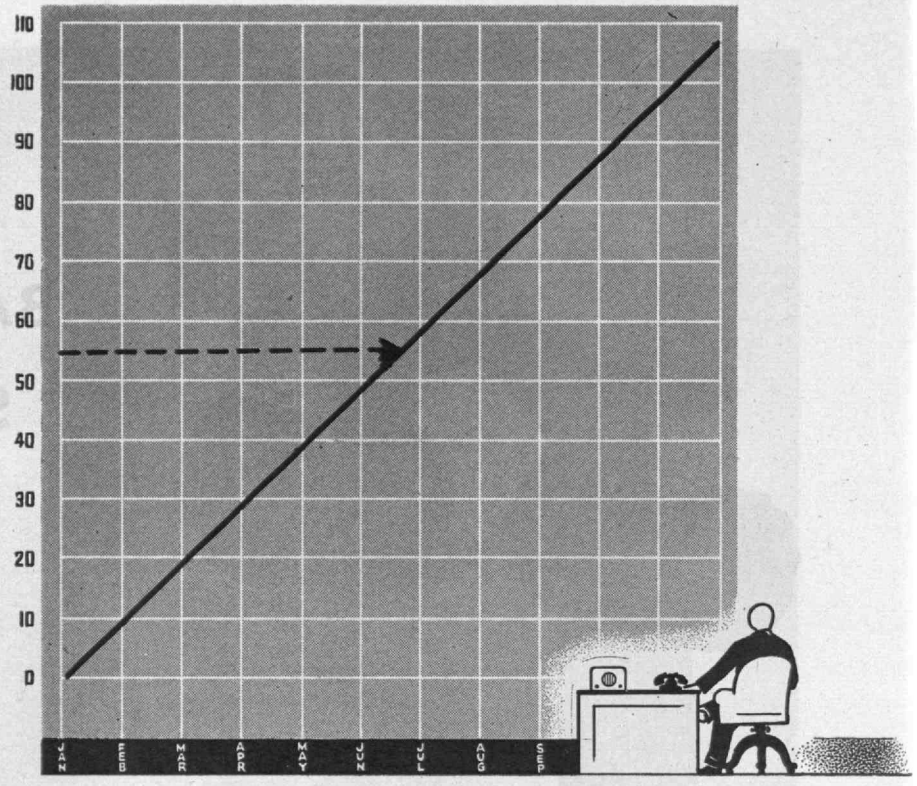
THIS is the ideal instrument for dissection, preliminary study, and for examinations that do not require high magnification. The long working distance, the fact that the object is seen as it really is—not inverted or reversed—and the stereoscopic effect, make this instrument invaluable. It may be placed directly upon a gross specimen when desired. Clear glass stage 100 x 100 mm. supplied. Characteristics of this microscope also include an extremely wide field, high eyepoint, and instantly variable magnification with parfocal objectives. Write for Catalog D-15. Bausch & Lomb Optical Co., Rochester 2, New York.

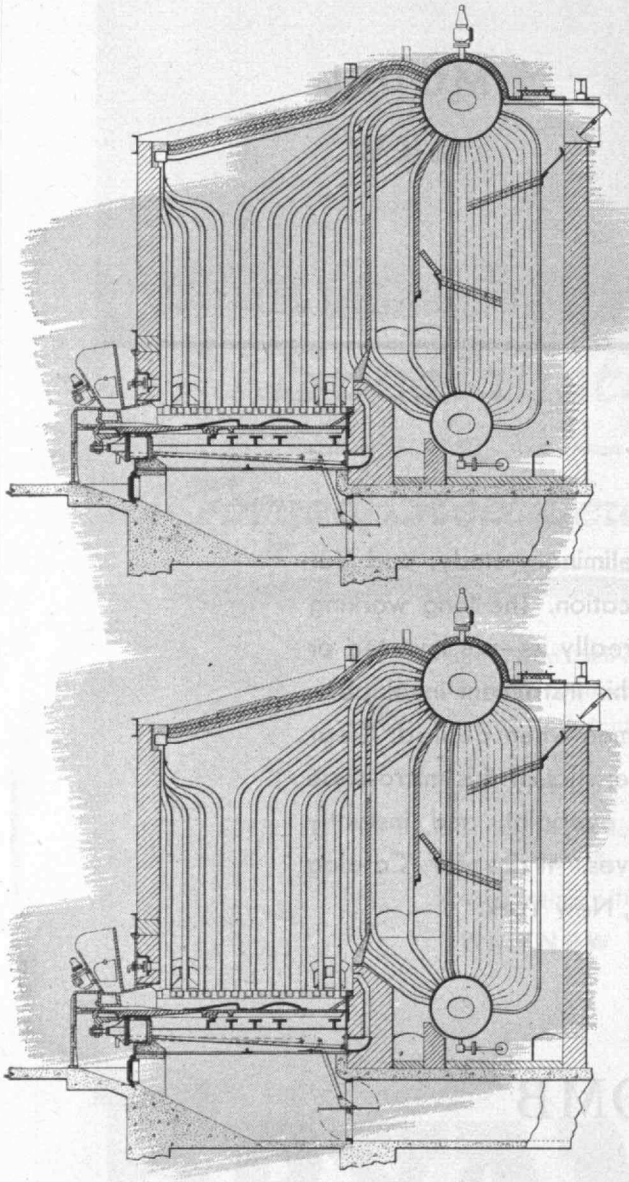
BAUSCH & LOMB

ESTABLISHED 1853

FIRST COST **$54,000**

ANNUAL FUEL BILL **$105,000**





Any cost-minded executive who has compared his company's annual fuel bill with the initial cost of his boiler units has discovered the high ratio of operating cost to purchase price which is characteristic of this class of equipment. For example, the two C-E Boilers shown at the left cost $54,000 installed, and the coal they consumed in 1944 cost $105,000. This example is above the average, but in other cases the annual fuel bill will run upwards from 100% of the installation cost. And, of course, this is not the whole picture of boiler operating cost, for labor, routine maintenance, repairs and outage losses total up to quite a substantial yearly figure.

All of which adds up to one simple fact—when it comes to buying boiler units, first cost is decidedly a secondary consideration. The total of annual operating costs is far more important. For obviously a unit that is engineered and built to provide something extra in efficiency of fuel consumption and serviceability will, within the first year of operation, prove to be a far better investment moneywise than a much cheaper unit providing a lower standard of performance. And when the figures are projected over the many years of the useful lifetime of such equipment, the advantage of buying on performance rather than price becomes a matter of simple logic.

Combustion Engineering boilers, fuel burning and related equipment are engineered and built to provide a high standard of lifetime performance. That they do so is attested to by the fact of their widespread use in the plants of leading industrial and utility companies.

Users of C-E equipment have long since discovered that paying for extra values in engineering and construction pays handsome dividends every year.

A-911

C-E

COMBUSTION ENGINEERING

200 MADISON AVENUE NEW YORK 16, N. Y.

You name it we'll mold it in RUBBER!

Acct: PRATT & WHITNEY AIRCRAFT DIVISION

Case History #453

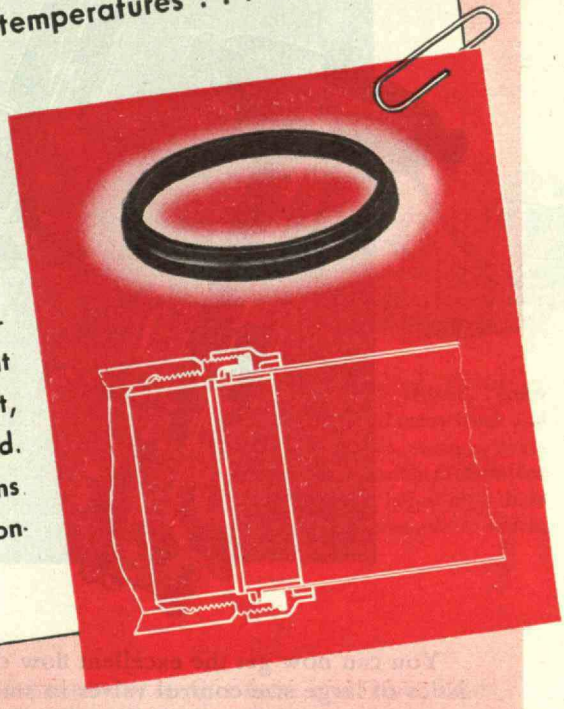
PROBLEM:

To find satisfactory leak-proof packing for ends of Intake Pipe on aircraft engine.

Existing rings permit leakage. Dirty to handle. Skived ends increase assembly cost. Not available in sufficient quantity. Replacement must be highly resistant to gasoline, oil and heat . . . seat to close tolerance . . . maintain dimensional stability under extreme temperatures . . . effect a sustaining perfect, leak-proof union.

SOLUTION:

Developed special design packing, precision-molded from Hycar oil-resistant synthetic rubber. Results of extensive testing under conditions far beyond ordinary demands:—excellent heat resistance, high modulus, good permanent set, perfect performance. Overall assembly cost lowered. Produced in great quantities exact to specifications. All tests proved in actual operation under all conditions. Seal is now a standard part.



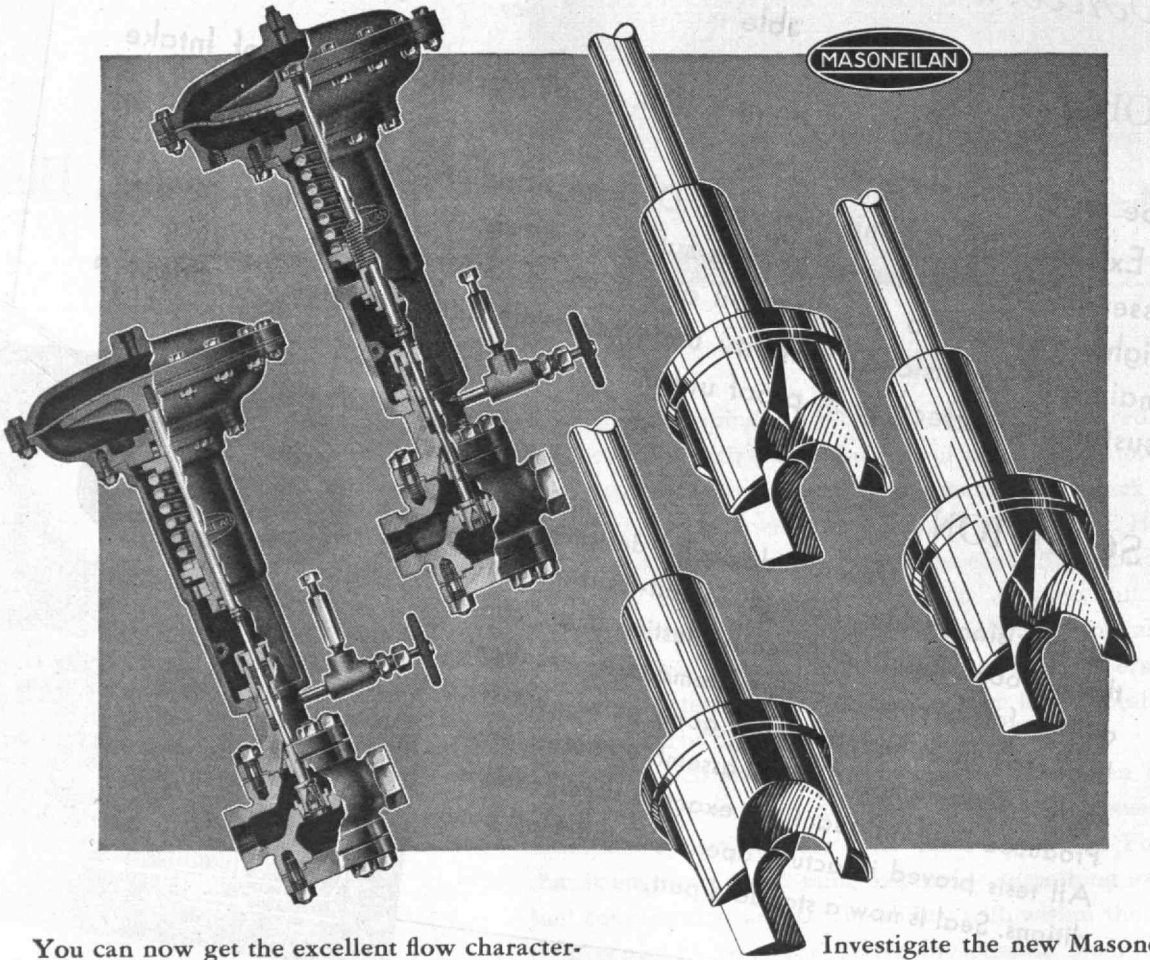
The solution to this problem is typical of the hundreds of assembly parts "bugs" we have been privileged to study and overcome for American industry. Perhaps it parallels a problem which confronts you, or suggests a remedy for other product parts difficulties. In either case, Acushnet's accumulated technical experience, engineering skill, unsurpassed laboratory and production facilities (which won five "E" awards during the war) are available for research, recommendations and prompt action. Send complete details of your problem, or requirements for the improvement of your product. We'll gladly make recommendations for the most efficient and economical solution.

Acushnet PROCESS CO.
New Bedford, Mass., U.S.A.
Precision-Molded RUBBER Parts & Products

MASONEILAN

Percentage Piston

CONTROL VALVES GIVE YOU FOR THE FIRST TIME WIDE RANGE PERCENTAGE FLOW CHARACTERISTICS IN SMALL VALVES



You can now get the excellent flow characteristics of large size control valves in small valves even down to ⅛″ by installing the Masoneilan *Percentage Piston* Control Valves. These new Control Valves . . . which are available in five trim sizes ¾″, ½″, ⅜″, ¼″ and ⅛″ . . . all provide a wide flow range with desirable reproducible characteristics *never before obtained in small valves.* The Masoneilan *Percentage Piston* Control Valves give you consistent performance under conditions of varying flow and pressure drop. When the flow is small, the change in flow for a unit change in lift is small. When the flow is large, the change in flow is large . . . the change *always* proportional to the quantity flowing.

Investigate the new Masoneilan *Percentage Piston* Control Valves. Bulletin 300 gives the complete story. Write for your copy today.

CHECK THESE FEATURES

- Special design of the plug and the seat ring permits excellent flow characteristics over flow ranges of the same magnitudes obtained in larger valves.
- High Lift — All sizes have a ½″ lift.
- Trim size is interchangeable and conversion is accomplished by merely replacing the plug and seat ring.
- Body materials — Bronze, cast iron, cast steel, forged steel or alloy steel are standard.
- Body design — Globe or angle type bodies, tapped ½″, ¾″ or 1″ are standard.

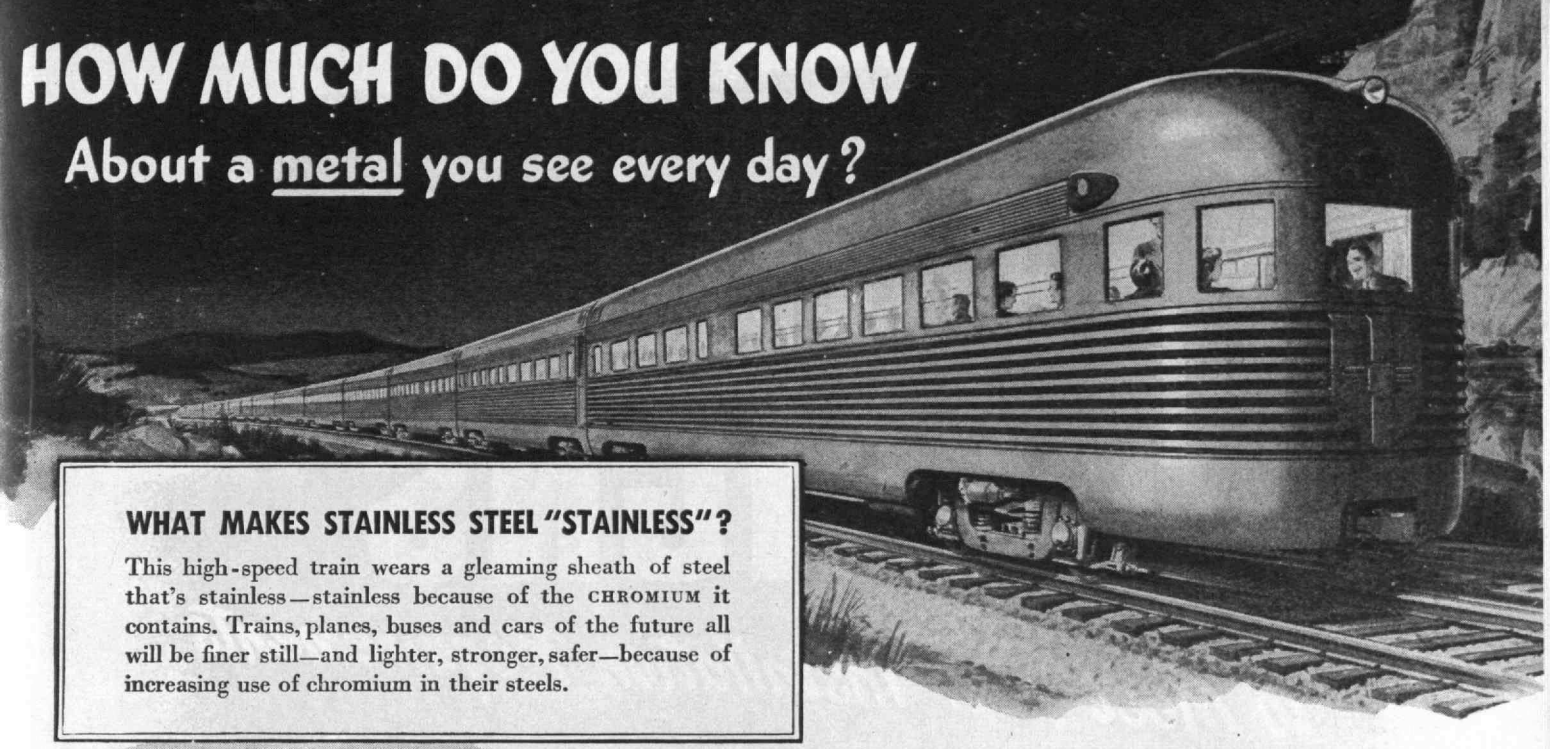
MASON-NEILAN REGULATOR COMPANY

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New York, Philadelphia, Pittsburgh, Cleveland, Chicago, Tulsa, Atlanta, St. Louis, Houston, Los Angeles, San Francisco. Mason Regulator Co. of Canada, Ltd., Montreal, Canada

HOW MUCH DO YOU KNOW

About a metal you see every day?

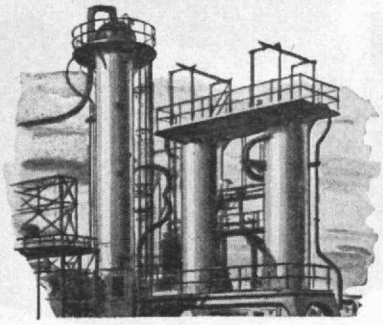


WHAT MAKES STAINLESS STEEL "STAINLESS"?

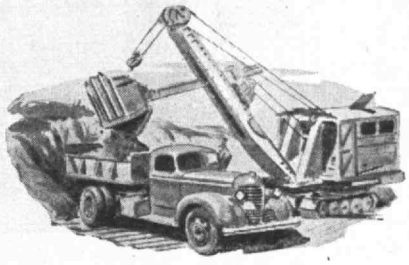
This high-speed train wears a gleaming sheath of steel that's stainless—stainless because of the CHROMIUM it contains. Trains, planes, buses and cars of the future all will be finer still—and lighter, stronger, safer—because of increasing use of chromium in their steels.



WHY DOES HER KITCHEN COME *"jiffy clean"*?—Sparkling pans, pressure cooker, tableware, shining sink and working surfaces in this modern kitchen all are highly resistant to rust, stain, corrosion—are easy to clean, attractive and long-lasting. Why? Because CHROMIUM has imparted these prized qualities to the steels of which they are made.



HOW DO REFINERIES STAND THE *"acid test"*?—Highly corrosive acids help refine America's oceans of high octane gasoline. But today's refineries withstand fierce acids, high temperatures and pressures—because CHROMIUM stoutly fortifies their metals.



WHY CAN THIS TRUCK *"take it"*?—The steels of many truck and automobile bodies, springs, gears and other parts contain CHROMIUM—for chromium helps give these steels amazing resistance to shock, fatigue, wear.

CHROMIUM is well known to many people for the powerful influence it exerts upon steel. Most of the alloy steels relied upon today for beauty, durability, and resistance to heat and corrosion now contain this interesting element.

Many years ago Units of Union Carbide discovered how to extract chromium from its native ore. They since have been constantly at work on the ever growing list of chromium alloys and their uses.

Union Carbide does not make or fabricate steel. ELECTRO METALLURGICAL COMPANY and other Units of UCC, however, supply to industry such wonder-working metals as chromium, manganese, and vanadium. With these, and the many other basic raw materials produced by UCC, industry improves a thousand and one products that serve all of us.

▼

FREE: "PRODUCTS AND PROCESSES OF UCC," *Booklet P-2, tells an illustrated story of many basic materials industry uses to build this world about us. Send for a copy.*

UNION CARBIDE AND CARBON CORPORATION

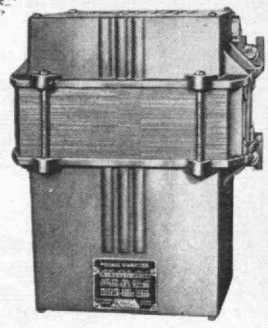
30 East 42nd Street UCC New York 17, N. Y.

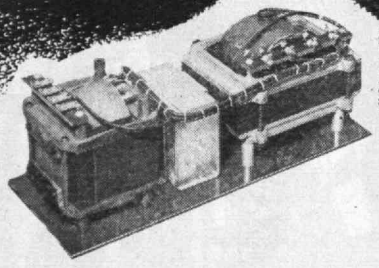
Principal Units in the United States and their Products

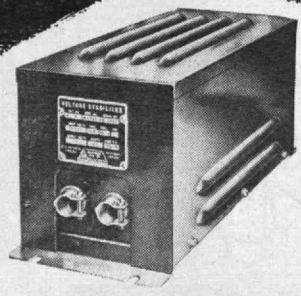
ALLOYS AND METALS—Electro Metallurgical Company, Haynes Stellite Company, Kemet Laboratories Company, Inc., United States Vanadium Corporation
CHEMICALS—Carbide and Carbon Chemicals Corporation **PLASTICS**—Bakelite Corporation **ELECTRODES, CARBONS, AND BATTERIES**—National Carbon Company, Inc.

THREE DESIGNS

to Meet Your Installation Requirements







Raytheon Voltage Stabilizers

CONTROL FLUCTUATING POWER SUPPLY TO ±½%

One of these three Raytheon Voltage Stabilizer models can do a great job in improving *accuracy* and *reliability* of your electrical equipment... if varying line voltage causes uneven performance.

Smooth out your input troubles. Eliminate power fluctuation. The cost is low. The improvement is often great. And one of these three models will meet your need.

Write today for the complete story—and determine how your own equipment can benefit. Send for our illustrated Bulletin DL 48-537.

Get these principal operating advantages:

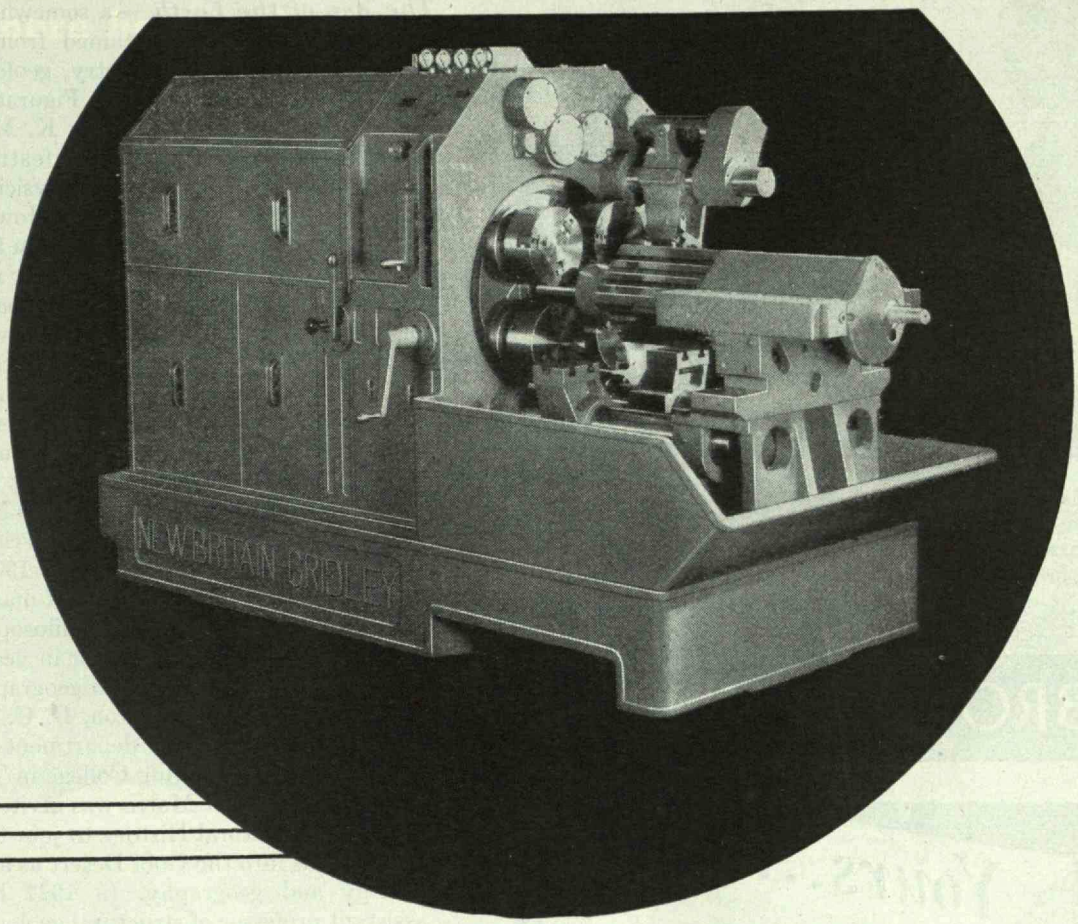
- **Control of output voltage to within ±½% of 115 or 230 V.**
- **Stabilization at any load within rated capacities.**
- **Quick response. Stabilizes varying input voltage within 1/20 second.**
- **Entirely automatic. No adjustments. No moving parts. No maintenance.**

RAYTHEON
MANUFACTURING COMPANY
WALTHAM 54, MASS.

ELECTRICAL EQUIPMENT DIVISION

Excellence in Electronics

WIDE OPEN SPACES MEAN QUICK, EASY TOOLING



There are many reasons why New Britain stands first in multiple spindle automatic chucking machines . . . but none is more important than its wide open accessibility through ***open end construction*** to all tools and chucks, and convenient chip removal. More pieces per hour because no time is wasted reaching for hard-to-get-at points.

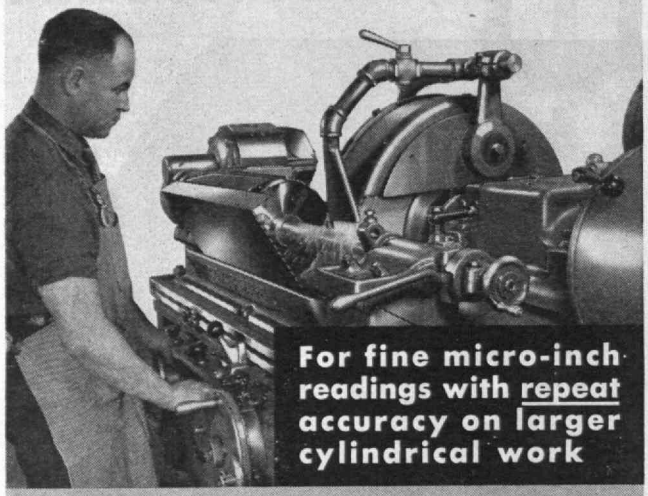
New Britain builds a complete line of Multiple Spindle Automatic Chucking Machines . . . four, six and eight spindles up to 12" capacity. Also a complete line of Multiple Spindle Automatic Screw Machines to 2¼" capacity.

NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

M-01

20 SERIES' EASE OF OPERATION
Saves Time in Grinding



For fine micro-inch readings with repeat accuracy on larger cylindrical work

Let us show you the production possibilities of these ***Electrically Controlled*** Plain Grinding Machines.

No. 20 (10"x 18")
No. 22 (10"x 36")
No. 23 (10"x 48")

BS Brown & Sharpe Mfg. Co.
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BROWN & SHARPE



Here are valuable facts on actual applications of DRY ICE and CO_2 for every potential user of these vital materials—summarized from a recent Liquid survey. All applications listed are in practical use... Many of the wartime functions of DRY ICE and CO_2 have peacetime counterparts—*perhaps in your industry.*

Use this chart as a check-list for possible applications to your processes or problems... DRY ICE and CO_2 serve industry in many important ways including chilling lubricants, shrinking metals, packaging foods, processing oil, controlling paint quality, etc.

Ask for your copy of this free chart today . . . You'll find it helpful in many ways.

The Liquid Carbonic Corporation
3110 South Kedzie Avenue, Chicago 23, Illinois
Branches in Principal Cities of the United States and Canada

THE TABULAR VIEW

The Age of the Earth — a somewhat uncertain figure at best — may be ascertained from the facts which astronomy, physics, chemistry, geology, and other sciences place at our disposal. Figuratively speaking, of course, PROFESSOR FREDERICK K. MORRIS unfolds the wrinkles of the earth's careworn features to reveal (page 223) that the geologist and physicist provide only a partial answer to the question, "How old is the earth?" The mere asking of this question, in fact, provides sufficient cause to examine what is really meant by the earth and how we are to measure time, particularly in those distant days when the solid crust on which we abide was in a liquid or gaseous state and the concept of time had not yet taxed man's mental prowess. Fortunately, Professor Morris' clear exposition relieves us of the necessity of becoming engrossed in such abstruse topics.

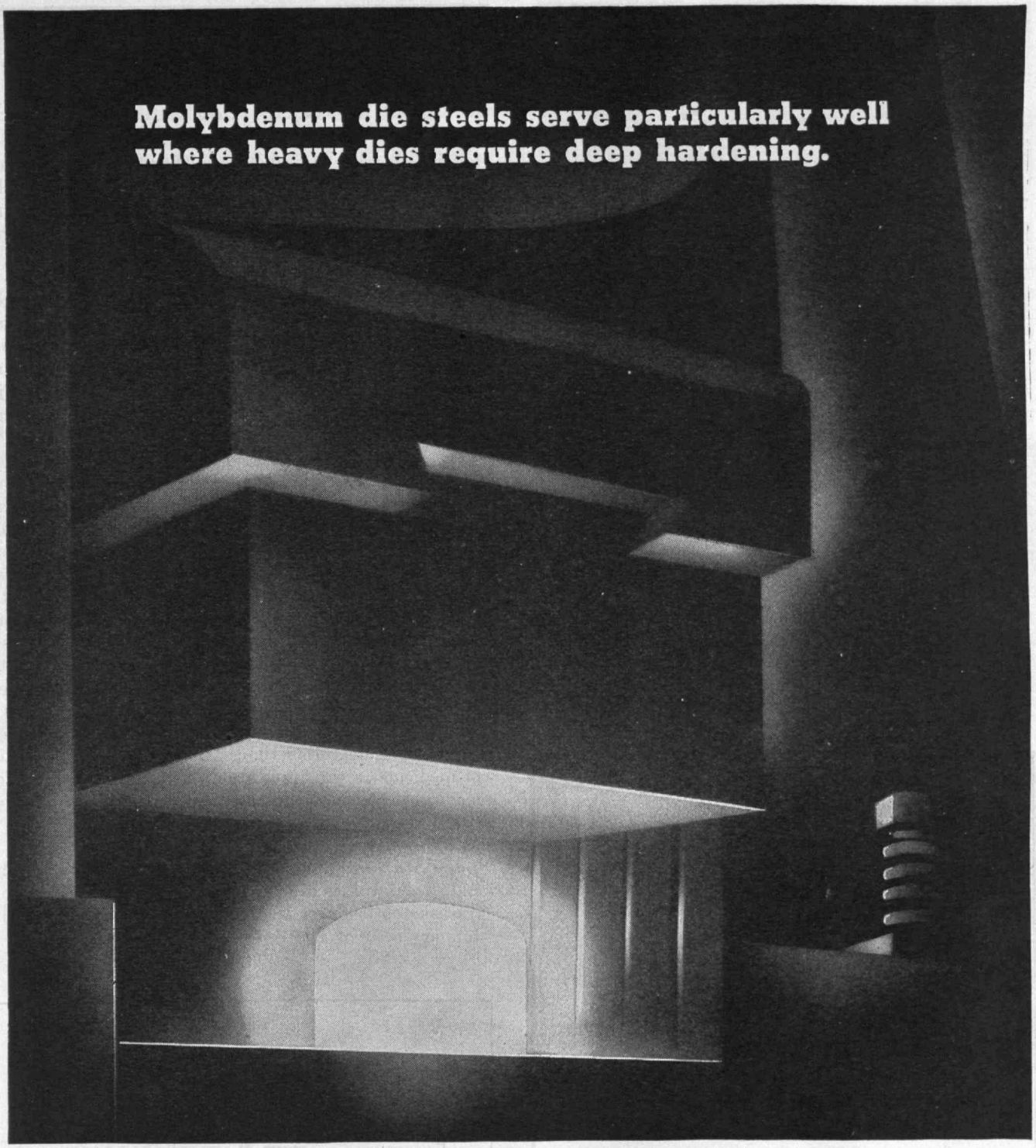
Professor Morris comes from Salt Lake City but obtained most of his early education in New York City. He received the degree of bachelor of science from the College of the City of New York in 1904. Columbia University granted him the degree of master of arts in 1910 and the degree of doctor of philosophy in 1936. From 1914 to 1920 he was instructor in geology at Columbia and then served as adviser in geography to the Department of State in Washington, D. C. Between 1920 and 1922 he established the department of geology at the Government Engineering College in Tientsin.

In 1922 Professor Morris was invited by the American Museum of Natural History to join the Central Asiatic Expeditions into the Gobi Desert as associate curator of geology and geography. In 1927 he was appointed assistant professor of structural geology at the Institute, becoming associate professor in 1928 and professor in 1931.

Technology's Radar School trained more than 8,800 Army and Navy officers and civilians in the principles and techniques of radar between June, 1941, and December, 1945. Normally the end of the war would also see the conclusion of war training programs, but the important work of this school, once shrouded in deep secrecy, is not to be terminated. Rather, as WILLIAM H. RADFORD, '32, Associate Professor of Electrical Communications, discloses (page 227), the war training program has led to a new curriculum in electronics for naval officers, as important in peacetime as the former program was during the war.

Having been associated with the Radar School since its beginning, Professor Radford, associate director of the school, speaks with authority on the school's origin, growth, and activities. After having received the degree of bachelor of science in electrical engineering from Drexel Institute in 1931, Professor Radford came to the Institute and in the following year was awarded the degree of master of science. He has remained at the Institute ever since. From 1932 to 1939 he was research assistant in electrical engineering, being engaged in work at Round Hill, where a program of studies of properties, light penetration, and methods for local dissipation of

(*Concluded on page 214*)



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

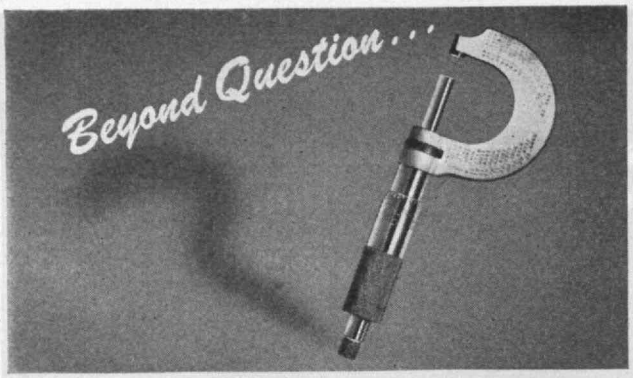
ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

MOLY

500 Fifth Avenue · New York City



When it's a STARRETT "Mike"



Your machine workers and inspectors take the accuracy of a Starrett "Mike" for granted and what's more, they have no question of your knowledge of tools and your desire to provide them with the finest when you standardize on Starrett Micrometers in every tool crib.

Familiarity with and confidence in the precision tools you provide is an important factor in both the quality and quantity of precision work your shop turns out. That's why it pays to ask your supply house for STARRETT Micrometer Sets.

THE L. S. STARRETT CO., ATHOL, MASSACHUSETTS, U.S.A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
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BATH
IRON WORKS
CORPORATION

Shipbuilders and
Engineers

•

BATH, MAINE

THE TABULAR VIEW

(*Concluded from page 212*)

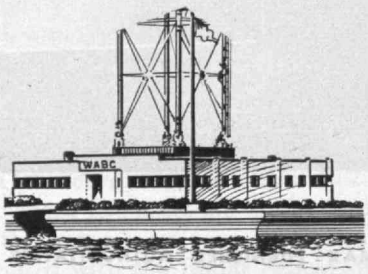
fog was carried out under the direction of Professor E. L. Bowles, '22. Professor Radford has progressively held the position of instructor, assistant professor, and associate professor in the Department of Electrical Engineering.

Technology and Medicine supplement one another in today's medical practice, for new techniques and instrumentalities make possible extension of man's knowledge of man's health. At the Institute the two fields are united in the Department of Biology. The possibilities in the field of applying the principles of the physical sciences to medicine are discussed (page 232) by KURT S. LION, Assistant Professor of Applied Biophysics.

Dr. Lion's education was obtained in Germany, where he completed work for the doctorate at the Technical Institute in Darmstadt in 1932. Following an assistant professorship at this institute, Dr. Lion established his own laboratory of applied physics in 1934 and a year later was called to serve as assistant director of the Institute for Radiology and Biophysics at the Turkish State University at Istanbul. From 1937 to 1941 he was assistant to the director of the Physics Institute, University of Fribourg in Switzerland, and since 1941 he has been with the Institute's Department of Biology. He heads a laboratory of applied biophysics, the activities of which embrace, among other things, the training of graduates in medicine in the application of physical methods for medical practice and research under the sponsorship of the Baruch Committee on Physical Medicine.

Space Station, proposed by the Germans toward the end of the war, is discussed by WILLY LEY, whose portrait sketch last appeared in the "Tabular View" of the January issue of The Review.

Speed with
Economy



We created the island and built this WABC Station on Long Island Sound

The safe way to get speed in building is to engage an organization that has always delivered it. Our reputation for fast, dependable construction dates back to 1917.

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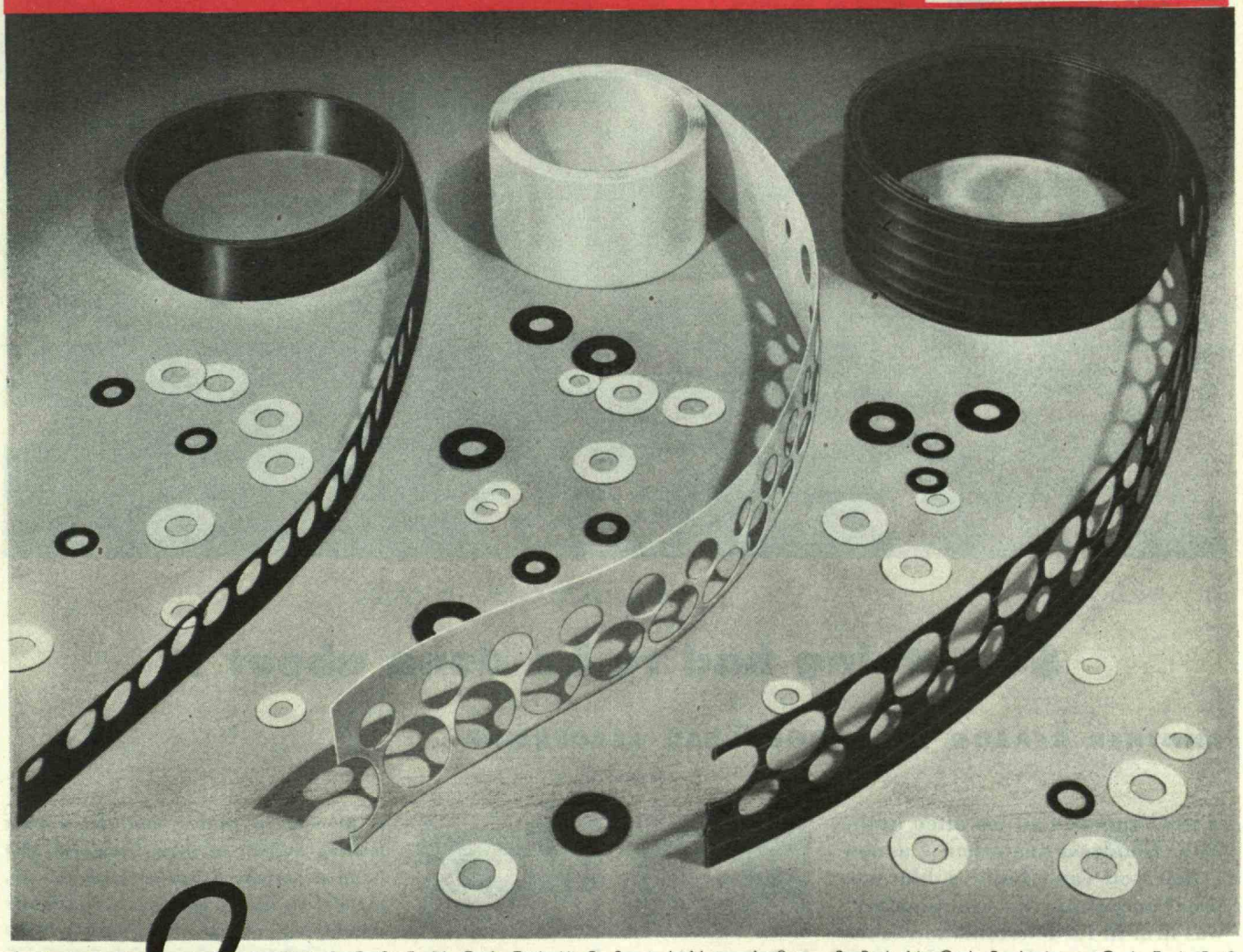
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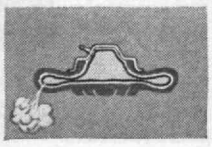
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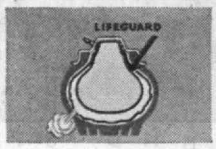
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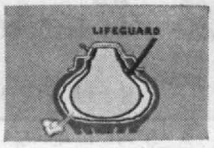
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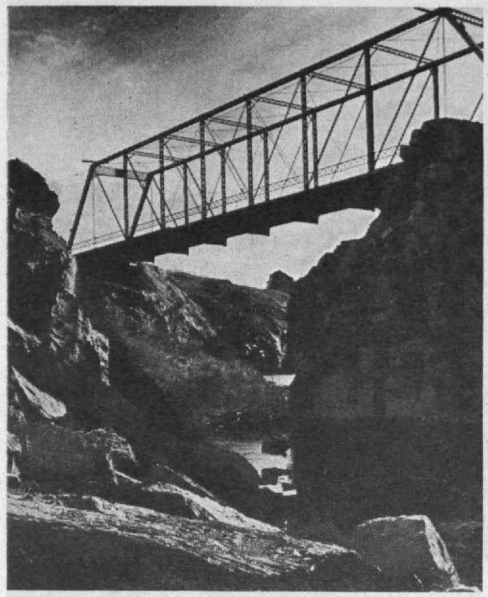
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AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY



Kosti Ruohomaa from Black Star

Rockland, Maine

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M.I.T. Photo

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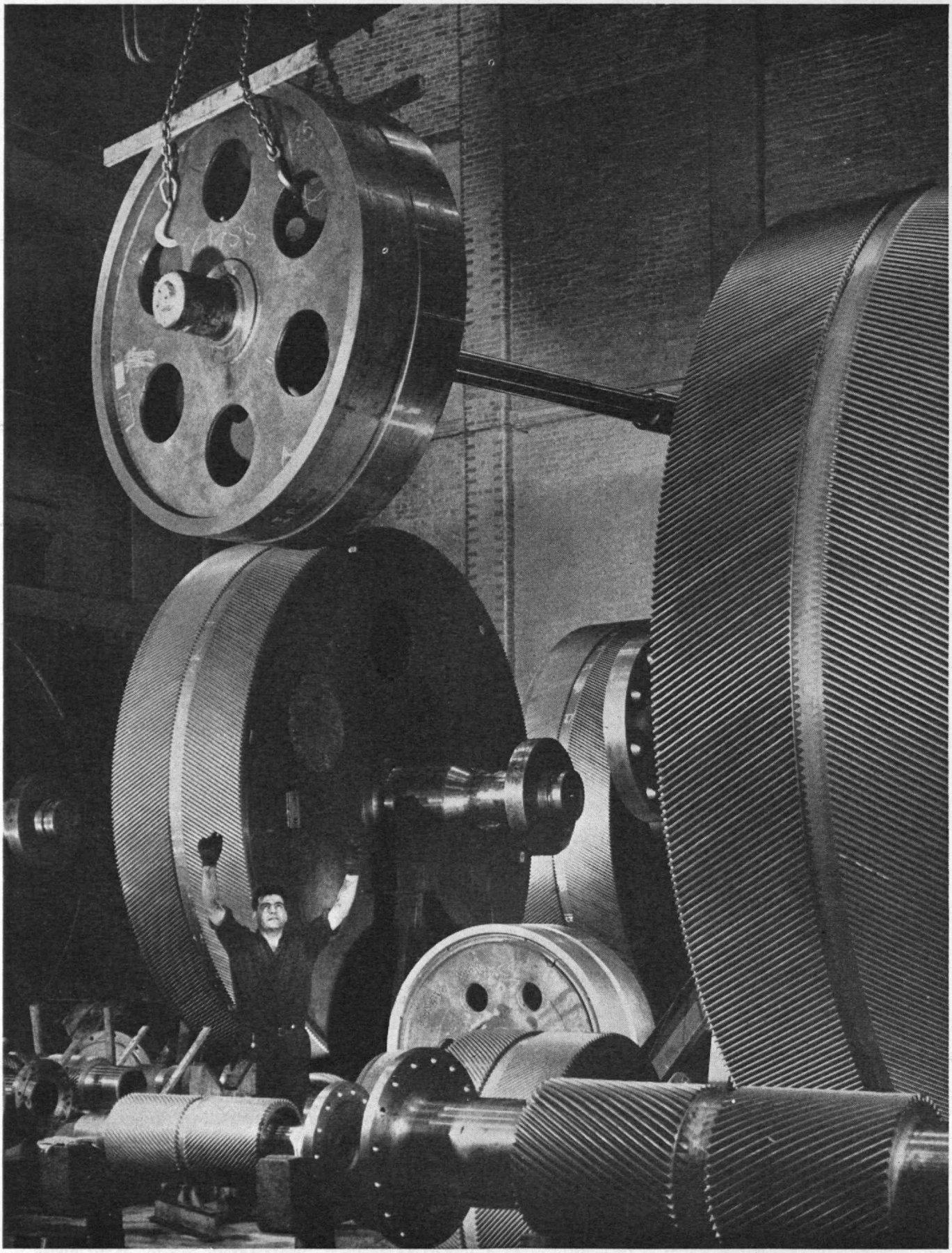
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THE
TECHNOLOGY
REVIEW

Vol. 48, No. 4

February, 1946

The Trend of Affairs

Bittersweet

STEREOISOMERISM, differences in the spatial arrangement of atoms within molecules, may differentiate physiologically valuable from physiologically inert substances (as demonstrated in "Chemistry in Three Dimensions" in The Review for March, 1944), but other, almost equally subtle, alterations in molecular constitution may change beneficial substances to actually harmful ones. Take, for example, histidine, a nutritious amino acid, a component of proteins. By simple loss of one carbon and two oxygen atoms, a change known to the biochemist as "decarboxylation," the molecule of histidine is converted to that of histamine, a hormone-like substance. Histamine has been assigned a number of functions in human physiology, mostly functions of an adverse nature. For instance, histamine has been implicated in allergies. It is also thought to be the chemical mediator in cutaneous pain, which means that when skin is subjected to painful stimulants such as high heat or mechanical irritation, histamine is released from the skin tissues and affects sensory nerve endings to produce the sensation of pain.

Chemical similarity between beneficial and harmful compounds may also be found among the vitamins. Pyrithiamine, a slight modification of thiamine or vitamin B_1, not only lacks the vitamin effect of thiamine but also is capable of "blocking" thiamine. Such blocking occurs when pyrithiamine is administered to an animal whose diet contains ample thiamine; pyrithiamine then displaces thiamine from the complex reaction systems of carbohydrate metabolism where thiamine ordinarily performs its valuable functions. Thus, since pyrithiamine has no vitamin value, a condition of thiamine deficiency is produced. This antivitamin effect of pyrithiamine is useful to the experimental physiologist who may, by administration of pyrithiamine, produce thiamine deficiency in laboratory animals at will, regardless of the thiamine content of the animals' rations.

A familiar physiological differentiation between similar organic compounds occurs among the sugars. Taste is purely a subjective sensation that may not be gauged by objective measurements; hence difference in sweetness of various sugars is truly a physiological differentiation. Glucose (dextrose or corn sugar) and fructose (levulose, a sugar of honey) have exactly the same empirical formula, $C_6H_{12}O_6$. These sugars have, furthermore, only minor differences in molecular structure. Both are straight chain compounds, but in glucose an oxygen atom is attached by a double bond to a terminal carbon atom, whereas in fructose the corresponding oxygen is attached to the next-to-the-end carbon. Despite this almost identical chemical constitution, glucose and fructose differ markedly in sweetness. On the basis of the widely used sweetness scale, in which sucrose, common cane sugar, is taken as the index and is assigned a sweetness value of 100, fructose has a sweetness of 150 and is the sweetest of the commercially used sugars. Glucose, on the other hand, has a sweetness value of but 60. This relationship has led to the recent perfecting and patenting of a process for converting glucose to fructose in order to increase the sweetness supplied by a given amount of sugar; for the prime characteristic of any sugar is sweetness.

A most striking example of physiological differentiation, again a difference in taste, also occurs among the sugars. Sucrose, as we have seen, is used as an index of sugar sweetness and is, in fact, the sweetest sugar except for fructose. Yet when the eight hydroxyl (OH) groups of the sucrose molecule are replaced by acetyl (CH_3CO) groups, the resultant compound, sucrose octa-acetate, is one of the most intensely bitter substances known.

Enzymes in Industry

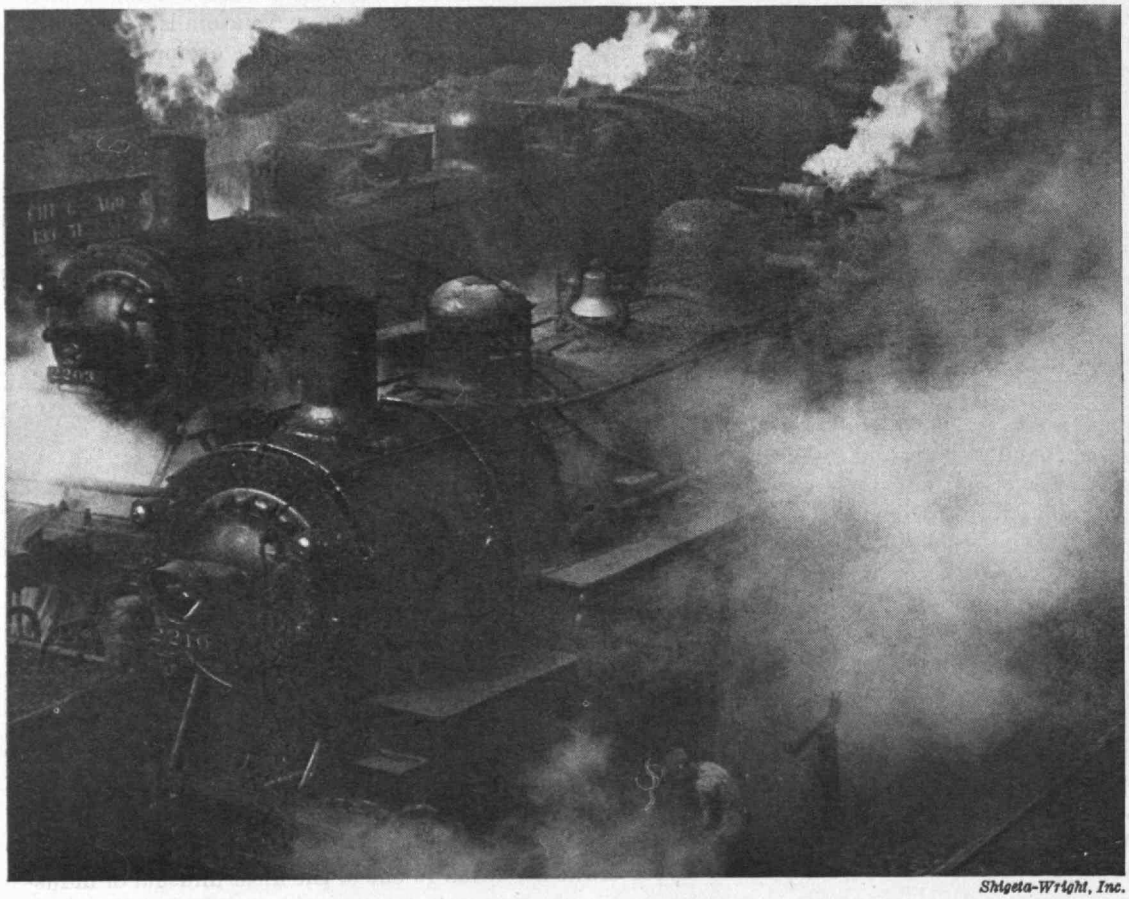
NEWS that the textile industry is currently consuming about 2,000,000 pounds of powdered enzymes and about 15,000,000 pounds of enzymes in liquid form each year draws attention to one of the most unusual of indus-

trial chemicals. Enzymes are protein catalysts produced in infinite variety by all living organisms. Of the thousands, if not millions, of specific enzymes believed to exist, only about 30 have so far been obtained in purified, crystalline form. All of this handful have proved to be large protein molecules, beyond the chemist's present power of synthesis.

Reactions that proceed at all in the laboratory only by use of high temperatures or harsh chemicals, or proceed too slowly to be practical economically, advance smoothly at low temperatures and under mild conditions in the presence of the correct enzyme. So limited, ordinarily, is the range of reactions which a given enzyme will accelerate that some biologists visualize a "lock and key" arrangement between a specific enzyme and the particular type of protein, fat, carbohydrate, or other substance that it affects. Like other typical colloidal substances, enzymes are also quite sensitive to the degree of acidity or *p*H of the medium in which they are operating and to temperature, most of them being inactivated by temperatures well below the boiling point of water. This is not too surprising in view of the fact that by nature they normally function, in most cases, at blood temperature or below. In common with other proteins, enzymes can also be attacked by microbes and therefore must be produced and stored in sterile surroundings. But when enzymes are placed in the proper environment, they can be effective in extremely small amounts. Invertase can hydrolyze one million times its weight of cane sugar without appreciable loss of activity. Catalase obtained from beef liver (differing slightly from catalase obtained from sheep or pig livers) will decompose hydrogen peroxide when diluted to one part in 25,000,000. Enzymes also work at low concentrations when in the organism, the concentration of an individual enzyme within the living cell ordinarily being in the order of 0.01 per cent. It is possible, however, for a cell to contain hundreds of different enzymes, since most of the cell's protein content, exclusive of the structural proteins, may consist of them.

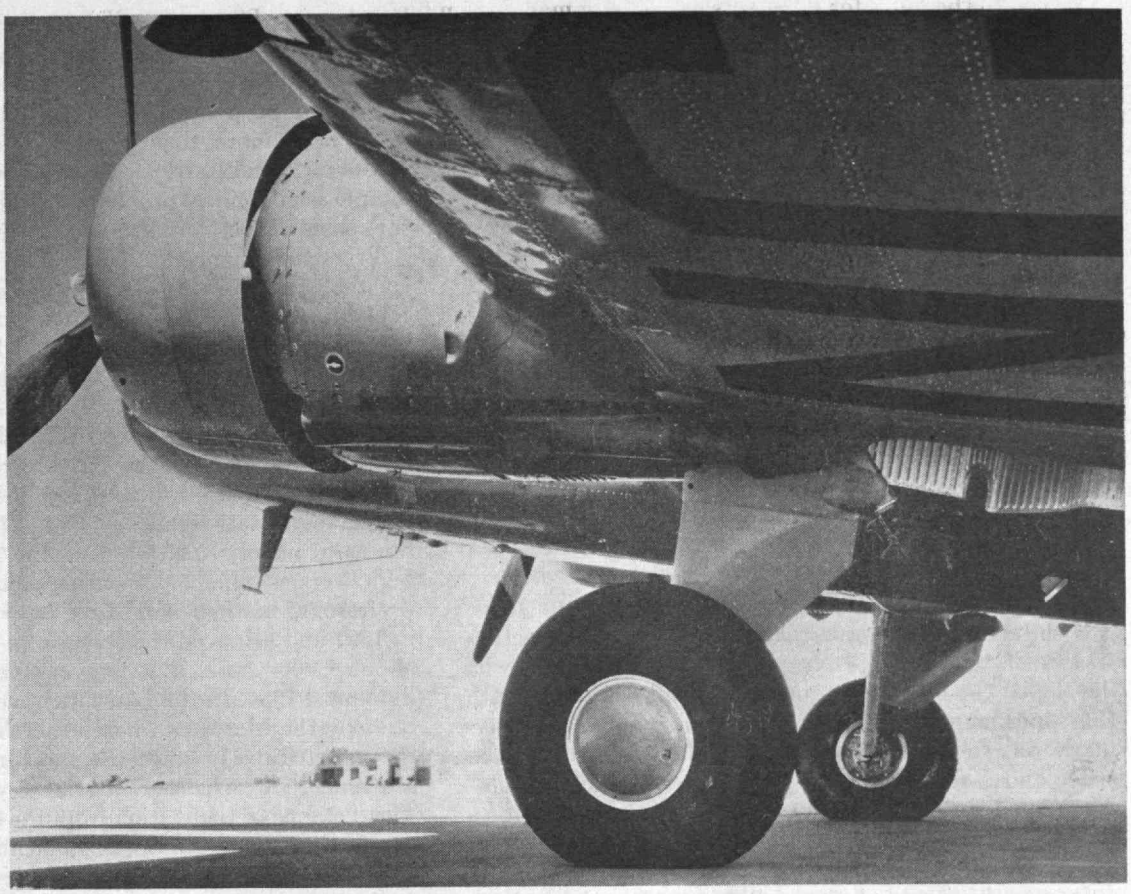
The direct use of more or less pure enzymes in industry may be considered to have started about the beginning of this century with the work of J. Takamine, who isolated and commercially applied certain enzymes obtained from molds. The same molds had been quietly working for centuries, however, producing the same enzymes which, quite unknown to the brewers, were responsible for the Japanese national beverage, sake. Similarly, other enzymes produced *in situ* by appropriate strains of yeasts and other microbes have made possible the production of wines and beers, the making of bread and cheese, the curing of tobacco, the bating of leather, the retting of flax, and many other ancient arts. Modern fermentation processes that yield citric acid, butanol, and other organic chemicals also depend on specific enzyme systems.

Industry uses enzymes instead of chemical or biological agents because greater control and better quality can thus be obtained. Occasionally the presence of micro-organisms would be undesirable. With enzymes, aseptic conditions may be maintained. Just the right amount of enzyme to carry the reaction to the point desired can be used, and the reaction can further be controlled by varying *p*H or temperature. Thus the bating of leather was originally accomplished by introducing into the liquor surrounding the hides the excreta of various animals. Later it was recognized that either pancreatic juices or certain strains of microbes found in these excreta were the motivating agents. The use of cultures of these microbes in the leather pits was not always successful, however, for many exter-



Shigeta-Wright, Inc.

▲ *The Nineteenth Century iron horse enabled our grandfathers to develop this nation's industrial resources, but . . .*



. . . the silver bird of the Twentieth Century makes all the world our province for building friendly relations.

nal conditions could modify the rate at which the microbes secreted their enzymes, and the leather would emerge too soft or with other failings. More precise control was obtained when the isolated enzymes, today obtained from the pancreas or from certain molds, were used.

Enzymes are used in the textile industry (and also in paper making) to reduce the viscosity of the starch and casein sizing materials without unduly reducing their strength, the use of raw starch and casein having virtually disappeared. Later, when the sizes must be stripped off the cloth in preparation for such steps as dyeing, enzymes are again summoned, this time to digest the size completely.

Enzymes are frequently used to change carbohydrate molecules so that they become more soluble or fermentable. The brewer can thus produce more alcohol from a ton of wheat or corn, and the candy maker can produce syrups of high density which will not crystallize. The soft center in chocolate candies owes a debt to the enzyme invertase, for by adding a small amount of enzyme to an easily handled hard center before it is dipped, the center will later soften to the required consistency because of the breaking down of the sugar by invertase.

Expendable Optics

BECAUSE of their unexpectedly crystal-clear transparency, more than casual interest has been given to a group of plastics which have been developed within the past decade. Boudoir items, in which decoration vies with good taste — and frequently becomes victor — have provided the principal commercial applications for molded plastic "crystalware." But combs, picture frames, or cigarette boxes have by no means exhausted the possibilities of the more recent additions to the family of plastics. Freedom from color, lightness of weight, and high transparency, coupled with the comparative ease with which they may be molded inexpensively on a mass-production basis, hold promise that transparent plastics will be welcomed in the field of optical engineering.

Some of the first samples of methyl methacrylate to be brought to this country from England were molded into optical elements for inexpensive cameras, and tolerably good photographs were made with simple plastic lenses of a decade back. Since then, rapid strides have been made in the production of lenses, prisms, and other optical elements which are molded from plastic instead of being laboriously ground and polished from crown or flint glass. Already plastic optics has been used in the manufacture of wartime telescopes, binocular attachments, and in an experimental aerial camera lens.

Experimental work in the field of television has brought forth the design and construction of a plastic correcting lens for use in projection television receivers. Because of the unusual curvature of the lens, its large size, and the need for mass production at low cost, plastic optics finds a natural application here. In fact, glass optical elements would be out of the question for this particular application because of economic factors, even if glass of the required size and shape could be made in the quantities required.

No new process or development ever completely supersedes that which it replaces, and certainly it is too much to expect that present molded plastics will provide serious competition to glass in the optical industry. As might be expected, molded plastics have their drawbacks as well as their advantages. They are soft and easily scratched. They are not available in the range of refractive indices obtainable in glass, although polystyrene

may be used for elements ordinarily made from flint glass and the characteristics of crown glass are met by a plastic bearing the mouthy name of polycyclohexylmethacrylate. It is, of course, necessary to consider these factors in applying plastics to optical systems.

But against these disadvantages, plastic optical elements have features making them well suited to the production of large, nonspherical optical parts. Moreover, molded plastics are well adapted to mass-production techniques and can be produced at low cost with sufficient precision for certain kinds of optical parts. Where lightness of weight is important, they more than compete with glass. Inexpensive cameras, opera glasses, telescopes, and perhaps even toy microscopes come to mind as legitimate applications. But the low-cost feature (where quantities of identical units are required) makes molded plastics well adapted to the field of expendable optical instruments.

Space Station

By Willy Ley

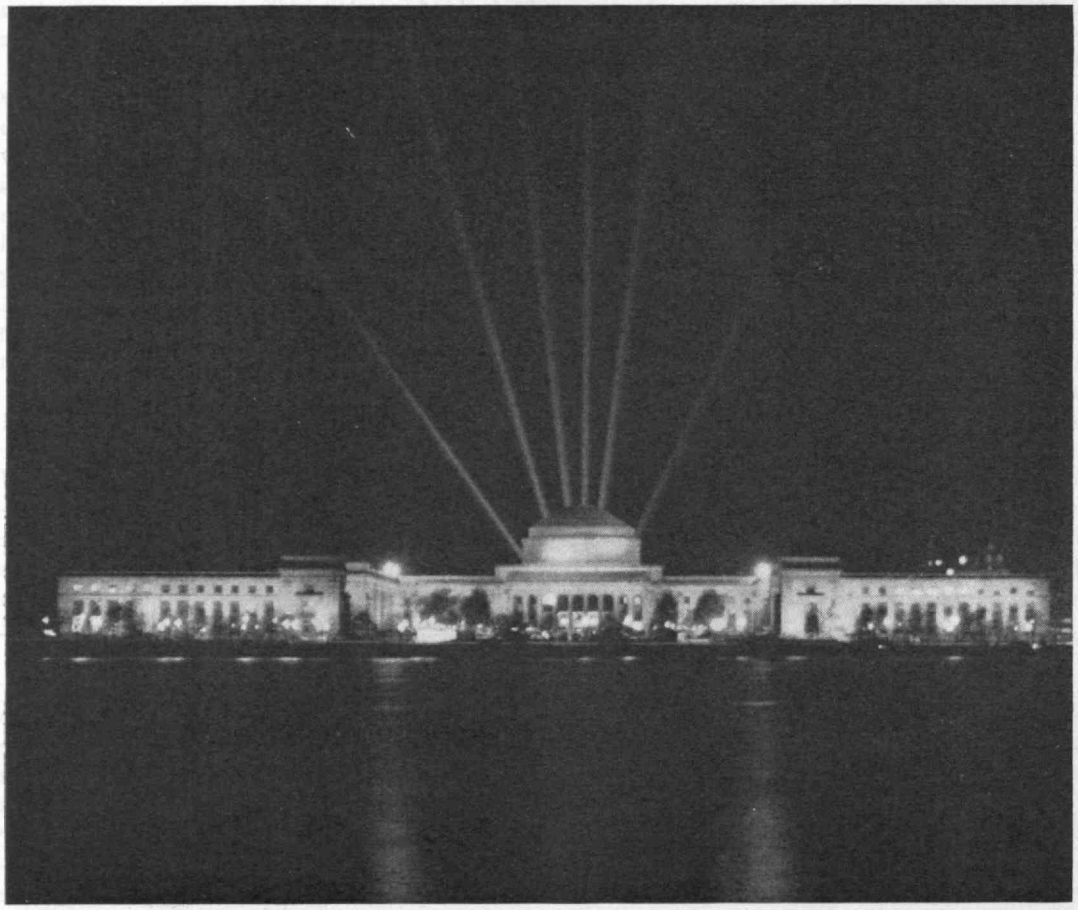
IN the course of the investigation of the scientific activities of the corps of Nazi rocket-research men, who developed the long-range rocket V-2 and were busy with the super-long-range rocket V-3 at the time Nazi Germany was subjugated, preliminary plans for a station in space and a so-called "sun gun" were brought to light. The report stated that there were found such plans for a station intended to circle the earth some 5,100 miles above the surface.

It may be doubted that whatever plans have been found can justly be called preliminary plans. The Nazi scientists themselves regarded the station in space as a postwar plan, roughly half a century in the future. Any plan which looks that far ahead has, of necessity, to be sketchy; there is no way of telling how one would build something 50 years from now. The proposal could not have been more than a set of calculations about the optimum distance of such a station, essentially a rather simple astronomical problem, modified only by the values for rocket thrust, and so forth, used in the assumptions.

From the engineering point of view it can be said that such a station in space is definitely feasible provided rockets of sufficient magnitude and thrust power are available. As a matter of fact, the whole problem is by no means a novelty, and the strangest aspect of the whole story is the attitude of the investigating officer who quickly credited the German general staff with the inception of the idea and who put the responsibility for this "fantastic scheme" where it did not belong at all.

The space station made its first appearance in a German fantastic novel which showed the rare combination of high literary value and scientific accuracy. Written by the professor of mathematics Kurd Lasswitz, it was published in 1897 and achieved the status of a steady seller, selling about 2,000 copies a year every year from publication date until 1930. In the Lasswitz novel the space station is built by the Martians whose spaceships cannot approach the earth directly since the moisture in the terrestrial atmosphere attacks the material of which they are built. The distance of the station from the center of the earth is one earth diameter, or about 4,000 miles from the surface.

The first scientific book in which the station in space made its appearance was Professor Hermann Oberth's first work on rocket theory, published in Munich in 1923. Oberth conceived the structure (*Continued on page 252*)



Crown — or Spanish Comb? Once more flood-lighted at night, the Institute took on added splendor during the Victory in Science exhibit held in the Great Court on November 10 to 12, when a group of Army searchlights produced these shafts of light radiating from the main dome.

The Age of the Earth

Physical Chemists, Astronomers, and Geologists Unite Their Knowledge to Fix Three Billion Years as a Conservative Estimate of the Earth's Age

By F. K. Morris

TWO camps of experts have given all the estimates which are used in most writings and lectures to estimate the age of the earth. The astronomer estimates the age of the sun and so limits the age of the planets, which are the sun's children. The other group answers to such names as "geochemist," "physical chemist," or "expert in radioactivity." They study the disintegration of uranium, thorium, and other radioactive elements, and, by accurately weighing the relative amounts of disintegration products, they can tell how many years have passed since those atoms of uranium were enclosed in a crystal — that is, they tell the length of time since a given rock crystallized. This method has been triumphantly successful, and all men have accepted its results. The ages of our oldest rocks have been reckoned at 1,500,000,000 years, more or less, and the bet is on the plus side.

All popular discourses and even some technical reports call these time estimates "the age of the earth." On my bookshelf within easy reach I see a volume bearing this very title, and opening it, I find a symposium on the ages of certain samples of rock as estimated by their radioactive elements. The ages of these rocks are not the age of the earth; the crystallization of rock marks only one date in a much longer history of the earth.

Now where is the geologist all this time — he whose very name should make him custodian of the logos of the earth? His chief job has been and still is to study the details of the earth's visible rocks and put together in time sequence a vast history of fact about the earth. My memory easily recalls the time when geologists accepted a story of the earth, a story so complex that it must be long, so long that it covered a period which exceeded the time which astronomers of that day allowed for the formation of the whole solar system. Later, most fortunately, the science of astrophysics lengthened its time scale so that the geologist's earth could fit into it. And now let the geologist try to tell the age of the earth, humbly acknowledging the help of his colleagues in physics, chemistry, and astronomy.

We look first at the bedded sedimentary rocks, shales that once were muds, sandstones that were loose sand, and limestones, most of which were made by living creatures. Little more than a century ago, when men began seriously to study the earth by means of fact and inference from fact, the simple but immense truth was discovered that the younger beds of rock lie on top of older layers. This discovery represents a truth that is valid across the whole world, and by it alone the entire sequence of the rocks is made out.

Beginning anywhere you please, on any continent, but preferably in some broad plain where the rock layers are but slightly tilted, we follow down the sequence of rock layers. The older rocks lie beneath the younger ones, and then we find still older rocks under them, as shown in Fig. 1. Allowing for folding and erosion, we estimate time. Backward and downward we read into the past, guided unerringly by our principle of superposition until suddenly we come to granites and must pause to consider their significance.

Long ago, all granites were hot solutions. They could become part of our rock sequence in just two ways, by encroachment or by replacement. According to the first possibility, a great body of hot liquid granite may rise slowly from deep within the earth and encroach upon the overlying rocks, splitting them, melting them, or dissolving blocks of them, until granite liquid occupies the place where bedded rocks formerly existed. This encroachment continues until the liquid crystallizes into solid rock and ceases to invade. In Massachusetts the granite of Quincy came in this way as a huge body of granite liquid.

Alternatively, escaping hot solutions may rise from a

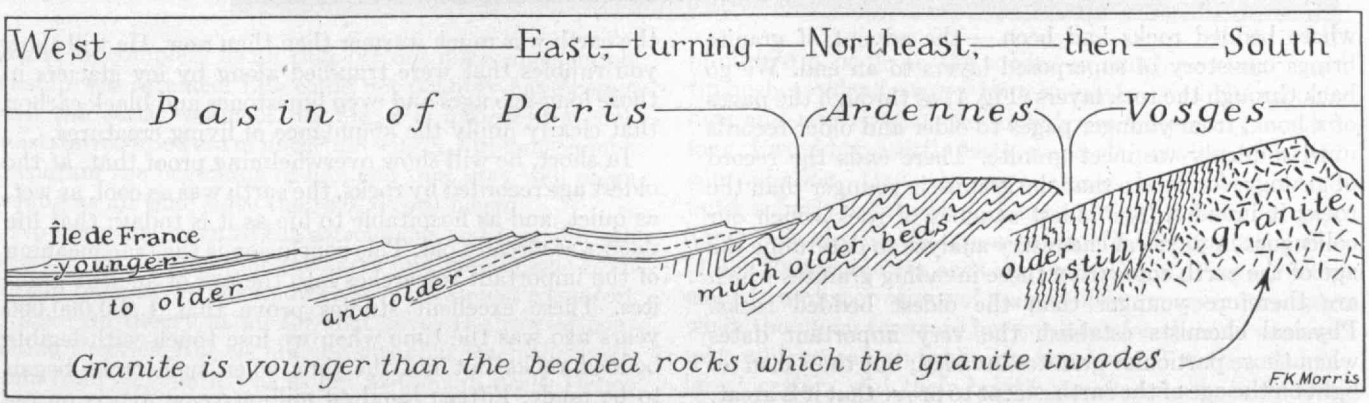


Fig. 1. The section shows how the geologist proves that older beds of rock lie underneath younger beds. The diagram takes a liberty with geography, for a wing of the Paris Basin intervenes between the Ardennes and the Vosges, but the age succession is correctly shown.

deep-lying mass of granite liquid and may slowly traverse the overlying rocks — stealing through them, intimately penetrating them, giving them heat, fluid, and chemical reagents, helping them to reorganize and change. Ever so slowly these hot juices work upward out of the granite liquid and through the bedded rocks, dissolving the original materials and replacing them with the stuff that makes granite. In Massachusetts the granite of Fitchburg was made in just this way, by replacing bedded rocks that began their story as ancient sands and muds.

In either case — whether the liquid granite invaded the bedded rocks directly or whether those rocks were slowly replaced almost molecule by molecule until granite sat

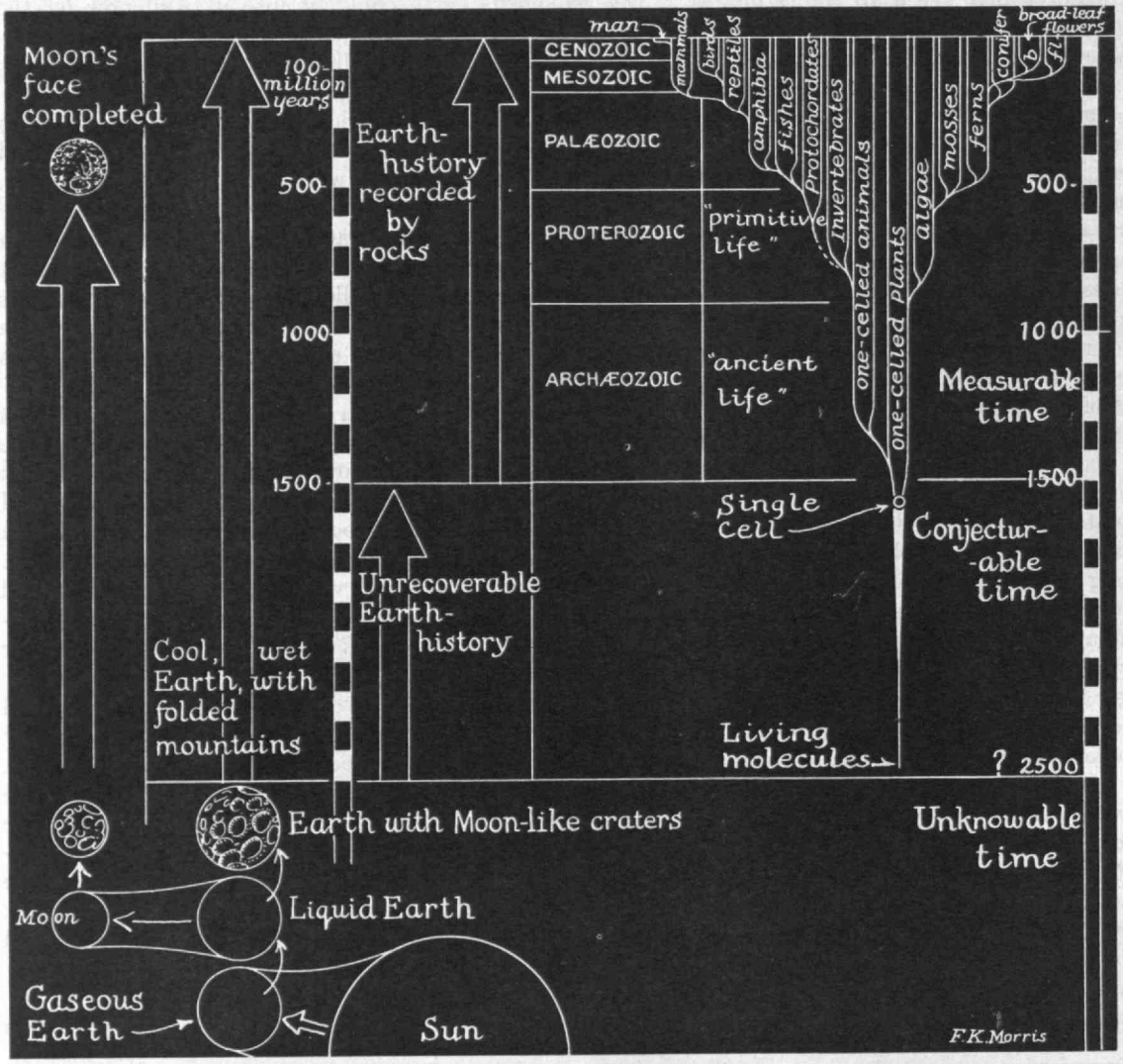


Fig. 2. A summary of the earth's history extends up the middle of the diagram, flanked by a history of the moon and of life. The oldest events are at the bottom. The left-hand earth-column shows but two chapters, a cosmic chapter and a long, cool-wet-earth chapter. To the right, the latter is subdivided progressively until the geologic eras are laid out in their true relation to the time scale.

where bedded rocks had been — the advent of granite brings our story of superposed layers to an end. We go back through the rock layers (Fig. 1) as through the pages of a book, from younger pages to older and older records until suddenly we meet granite. There ends the record of geology, for we see that the granite is younger than the rocks it invades. The oldest samples of rock which our colleagues in physical chemistry analyze to determine the age of the earth come from these invading granites which are therefore younger than the oldest bedded rocks. Physical chemists establish the very important dates when those particular granites invaded; but they shed no light on the age of the earth except to prove that it is great.

Now come out with the geologist and look at the truly oldest rocks, the bedded rocks which the granite invades. You will have to accept a lot of guidance or else take a course in geology to follow all of the points to be enumerated. But the geologist will prove to you that the bedded rocks of ancient time included fine clayey muds, thin-layered and of vast extent, such as are laid down in large bodies of shallow quiet water. They were muds which long, slow rivers brought down from broad, low, stable lands. The geologist will show you beds that were sandstones long ago, beaches and near-shore deposits, deltas of rivers reaching out into shallow seas. He will show you lavas and ash beds, no bigger than those of much more recent eras and certainly none that would hint that the earth was much warmer then than now. He will show you rubbles that were trundled along by icy glaciers in those long-ago ages and even limestones and black carbon that clearly imply the abundance of living creatures.

In short, he will show overwhelming proof that, at the oldest age recorded by rocks, the earth was as cool, as wet, as quiet, and as hospitable to life as it is today; that life itself was already old. This conclusion is the true meaning of the important researches into the age of ancient granites. These excellent studies prove that 1,500,000,000 years ago was the time when we lose touch with legible bedded rocks but not the time when such rocks began to be made. Fifteen hundred million years ago is an essentially modern date in the story of the earth.

We must infer a long era of cool-wet-earth history before our legible record begins. It is as though the history had been written in a great book whose leaves are layers of rock, and the first half of the pages had been torn out and burned in a furnace of hot granite. During that long era for which the rock record is lost, life must have commenced as a complex chemical process in sunlit, quiet waters. No bigger than molecules at first, the early living creatures evolved very slowly until, even before the legible rock record begins, they had attained the high complexity of one-celled plants and animals.

Thus we need a long time for the unrecorded cool-wet-earth era, long enough for an evolution as important (and almost as complex) as all that life has done since simple cellship was attained. Life could not possibly have begun until the earth was cool. In Fig. 2 is indicated a cool, moist, unrecorded era of uncertain length, but long enough to contain the beginning of life, and that may well mean as long as all time since the rock record began.

Now we shall turn to the astronomer and here our job is easier. He tells us that the earth and moon came from the sun but that no one knows how. It is almost a comfort to have no theory at all for that saves the row of conflicting theories. But we may be sure that when the earth came from the sun it was as hot as the sun itself. Hence we can confidently infer a hot-earth chapter during which the earth changed from a gaseous to a liquid body and thence to a planet whose thin crust still felt the heat of a liquid interior. In this last stage, most of its mountains were volcanoes and must have rivalled the craters of the moon.

Here the moon begins to help us, for it has kept the very features that formerly characterized our planet. We see mirrored in the moon a smaller image of the earth when its internal heat energy found vent in ring-shaped mountains, lava floods, and lifted or sunken fault blocks. The moon had no other way of making mountains except by volcanoes and very moderate faulting while the cool-wet earth learned a new way of making mountains, as we shall see. One of America's ablest geologists has recently published a book on the moon[1] in which he clearly distinguishes older features from newer ones on the moon's face and proves that the moon's readable story is very long. I would go a little further and claim, without fear of contradiction, that the moon must have been active until a fairly late period. I care not a jot whether you agree with closing the moon's cosmetic life about the end of our Palaeozoic era as is shown in Fig. 2. You are welcome to a plus or minus of many million years on the date when the moon forswore her compact for the rest of eternity and ceased to make up her face. But the moon's latest craters and their bright streaks of ash could not

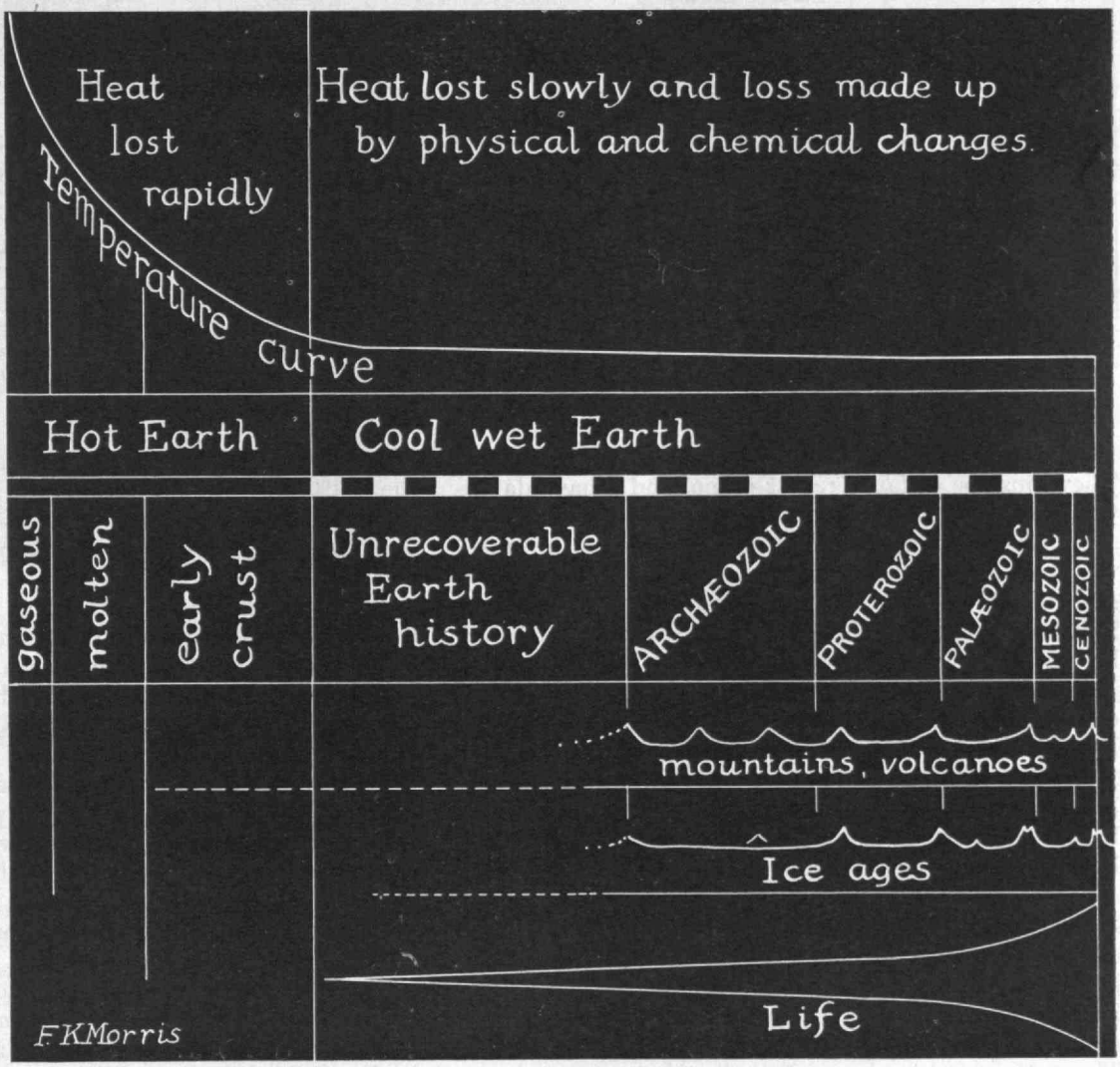


Fig. 3. The most important part of this figure lies at the junction between the Archaeozoic era and the era of unrecoverable earth history. The four curves, representing earth temperature, mountain-making, ice ages, and the development of life, show that at the earliest time recorded by visible rocks, the earth was in essentially the same condition as at present. Each black and white bar represents 100,000,000 years.

[1] Josiah Edward Spurr, *Geology Applied to Selenology* (Lancaster: Science Press, 1944).

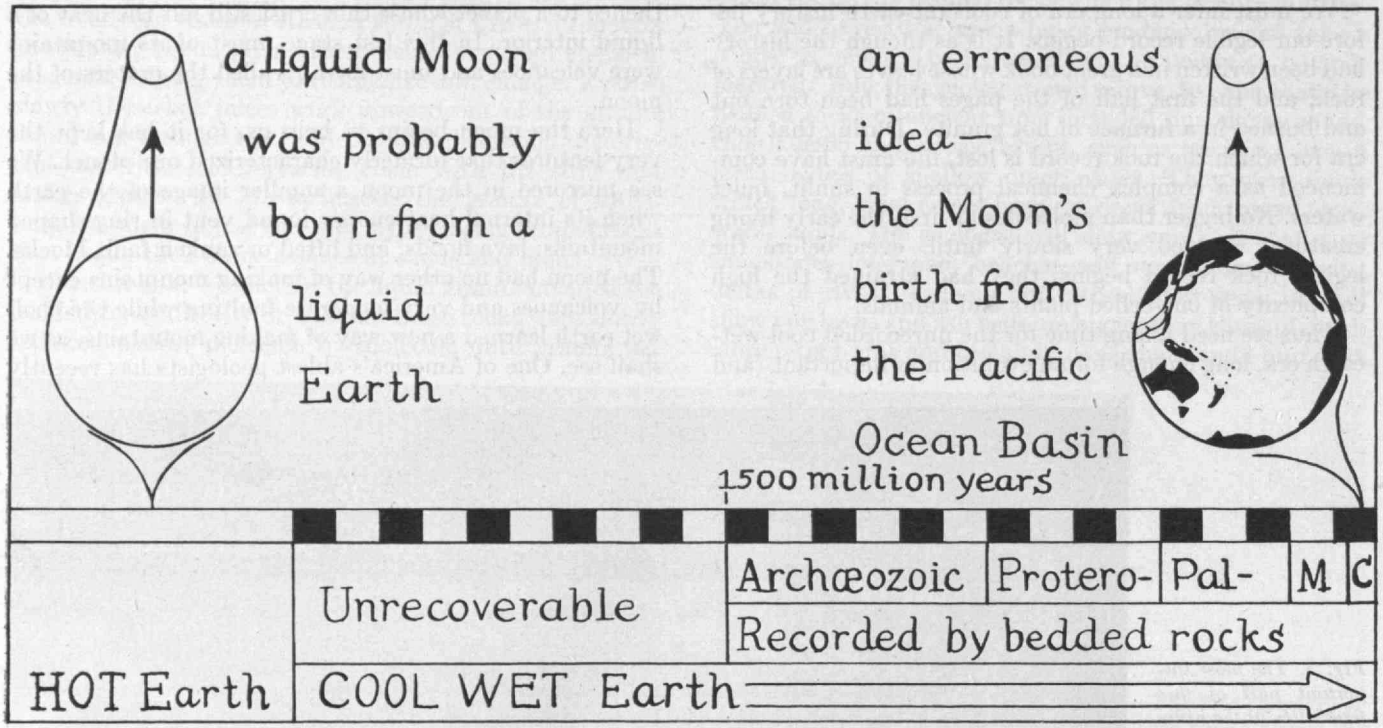


Fig. 4. This diagram illustrates the critical importance of the time scale in discriminating between incorrect ideas and inferences that can be supported by fact. The text explains the vast differences in time between the birth of the moon from the Pacific basin and its birth from the liquid earth.

keep their brilliant freshness forever, even on the moon. They must be of fairly recent origin, and I have dated them about 200,000,000 years ago.

On the much larger earth, seas formed when the crust was thick enough to shut in the internal heat. Ever since sea and land existed, rivers have eroded the land and carried the shavings into the sea. Whenever these muds have become very thick, the earth has folded them to form mountains like the Alps, Appalachians, or Himalayas. The cool-wet chapter of earth history has been characterized by folded mountains made of bedded sediments.

The age of the earth offers an acid test for some of the beliefs that are held not only by the man in the street but are heard even in major universities. I shall touch but one of these: Did the moon come out of the earth, and if so, when? That brilliant mathematician and scholar, Harold Jeffreys, shows that the earth by its own energy could never have given birth to the moon.[2] He holds that it is just within physical possibility that the sun might have aided the moon's birth by a series of rhythmically repeated tidal pulls, which he calls "tidal resonance." The earth must have been wholly liquid, must have been rotating more rapidly, and must have been nearer the sun than it now is.

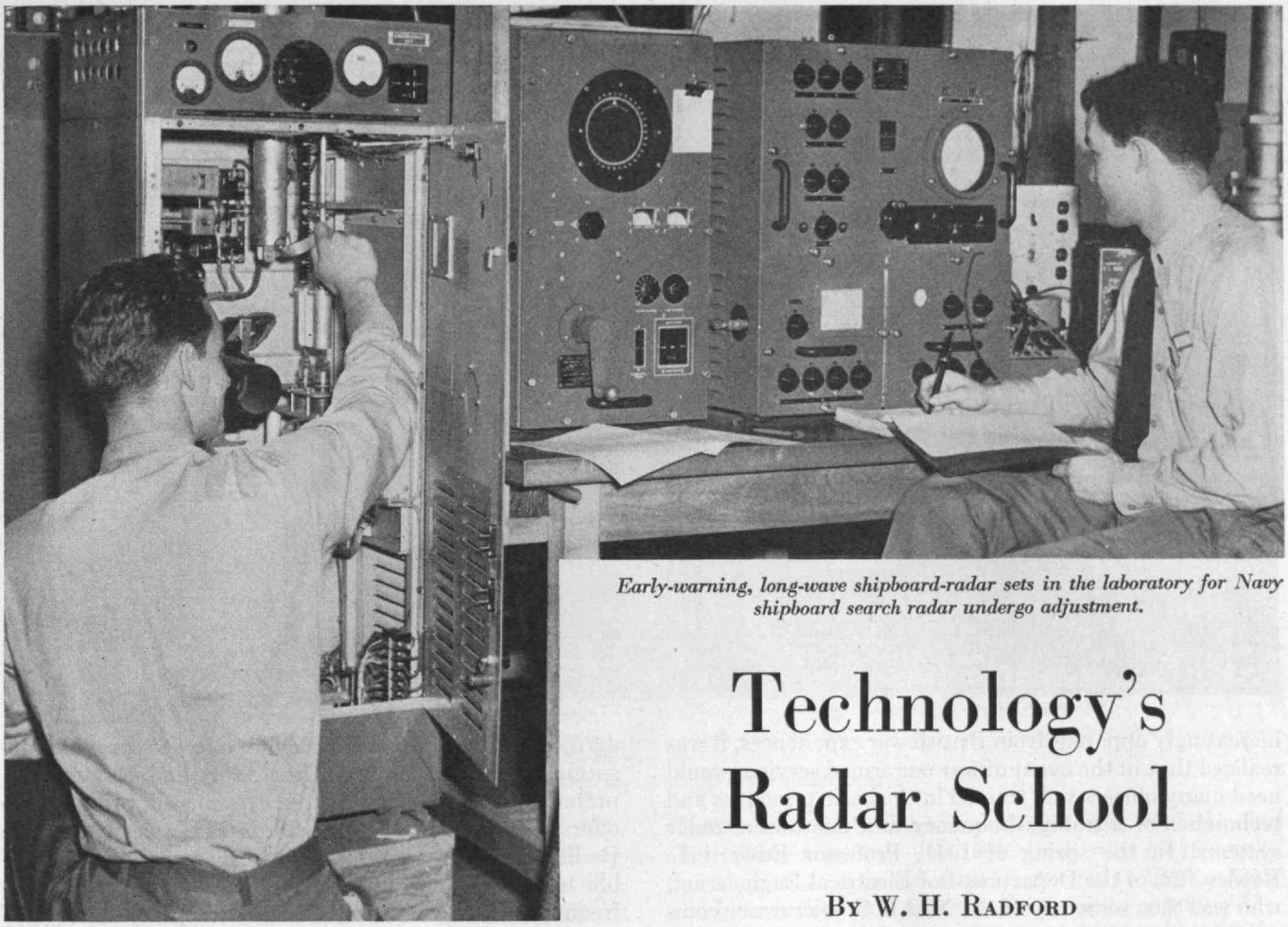
When, if ever, could this separation have happened? Only once were all necessary conditions favorable, and that time was during our hot-earth chapter. At the left of Fig. 4, you see the moon coming out of the earth during the molten period; and on the right is drawn the birth of the moon as fancied by most people, including, alas, many university instructors and not a few lecturers. These good people point to the huge round hole, which contains the Pacific Ocean, as the scar of amputation whence the moon was torn from the earth. They point to the volcanoes, active or but recently extinct, that rim the great hole and tell us that the earth is still bleeding lava and trembling with earthquakes around the margin of the scar.

This theory is poetry, not science. In quantitative fact, the moon is many times too big to have come out of the Pacific or out of all the earth's ocean beds combined. The moon is too old, for we can date the Pacific volcanoes and show that they belong to the very latest period of volcanism. We can date the depths and heights that rim the Pacific and show that they too were made well within the Age of Mammals. The age of the earth measures the magnitude of the libel we commit if we say that the moon might have come out of the Pacific basin.

The history of volcanoes agrees with the history of bedded rocks in pointing toward a long unrecorded era of thick-crust earth, which necessarily is the same as cool-moist earth. We find some volcanic action in all ages; but at times when big blocks of the earth's crust are heaving up or down along great faults, large volcanoes burst forth and floods of molten lavas pour out of fissures and cover vast areas. This action may continue for some millions of years before the volcanoes die out, the lava floods cease to flow, and a major volcanic period is past. Busy rivers then tear down the high volcanic cones and wear away vast amounts of the plateau lavas until only a geologist can prove that there was a volcanic period. After long quiescence — tens or hundreds of millions of years — new movements of the earth's crust begin, and new major volcanoes and lava floods appear, this time in quite different regions.

Looking back into the long recorded history, do we find that the older ages had more and greater volcanoes, bigger lava floods than those of later times? The answer is no, not in the recorded era. In Fig. 3 (*Concluded on page 252*)

[2] Harold Jeffreys, "The Origin of the Moon," *The Earth, Its Origin, History and Physical Constitution* (New York: Macmillan Company, 1929).



Early-warning, long-wave shipboard-radar sets in the laboratory for Navy shipboard search radar undergo adjustment.

Technology's Radar School

By W. H. Radford

With a Record of 8,800 Persons Trained in Radar Techniques, the Institute's Largest War Training Facility Is Being Converted to Provide a New Electronics Curriculum for Naval Officers

ESTABLISHED at Technology almost six months before Pearl Harbor, the Radar School composed the Institute's largest specialized war training activity. Unique in many respects and noted for the variety and high standards of its courses during the war period, the school served as one of the principal centers for training Army and Navy officers in the theory and applications of radar. At the completion of the war phase of its operations in December, the school had trained approximately 8,800 officers, enlisted men, and civilians, including practically all of the Naval Reserve "electronic specialist" officers who were responsible for procurement, installation, and maintenance of the air-borne and shipboard radar and related electronic equipment of the fleet.

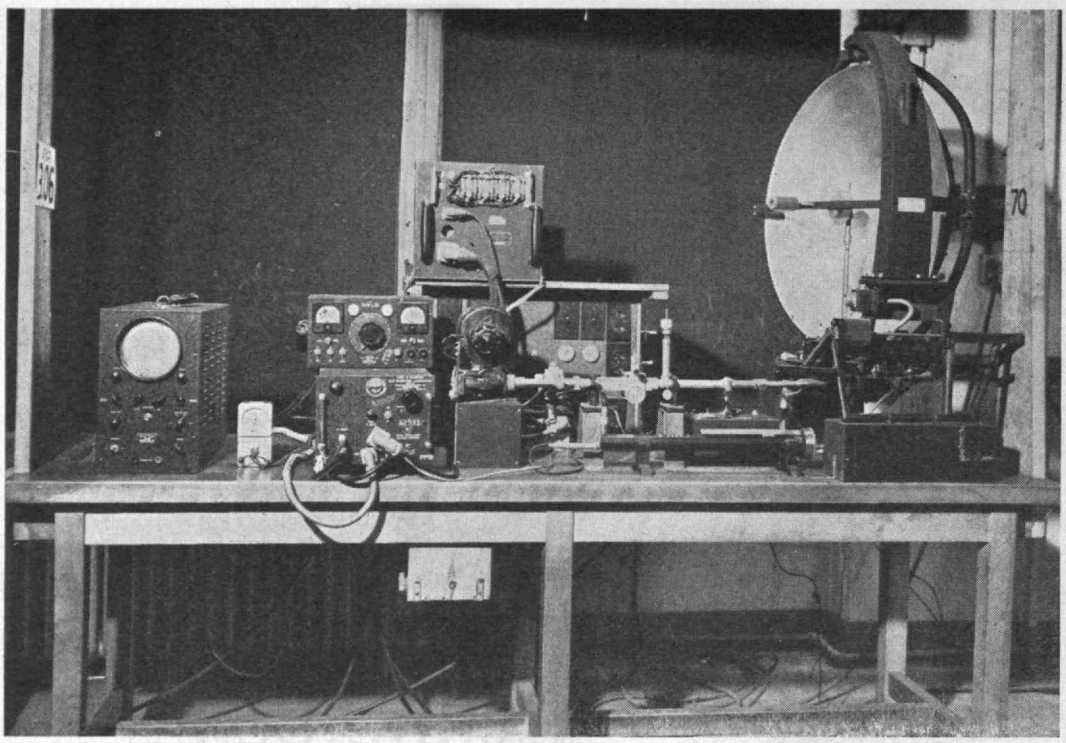
The importance of the war service rendered by the Radar School is indicated by the following passages in a letter which President Compton received recently from Vice Admiral Louis E. Denfeld, Chief of the Bureau of Naval Personnel:

> With the advent of radar and its several associated electronic implements of war, the Navy was confronted with the unprecedented problem of training thousands of officers in the specialized science of electronics.
>
> Early in 1941 when it became apparent that these electronic developments were to play a vital role in the ultimate outcome of this war, it was natural that this bureau should turn to the Massachusetts Institute of Technology for assistance in the training of technical personnel. . . .
>
> Over 4,500 officer graduates of this school have served the Navy with commendable efficiency on ships, aircraft, and at shore establishments all over the world. The efficiency and effectiveness of these officers reflect great credit to the training given at the Massachusetts Institute of Technology.
>
> On behalf of the Navy Department, I wish to express to you and to the members of your staff sincere appreciation for the tremendous task so successfully completed, the continuous cooperation and cordial relationship, all of which have been vital contributions to the successful prosecution of the present war.

In August President Compton received from Major General H. C. Ingles, Chief Signal Officer, a similar commendatory letter regarding the training which the Radar School had provided for Army personnel.

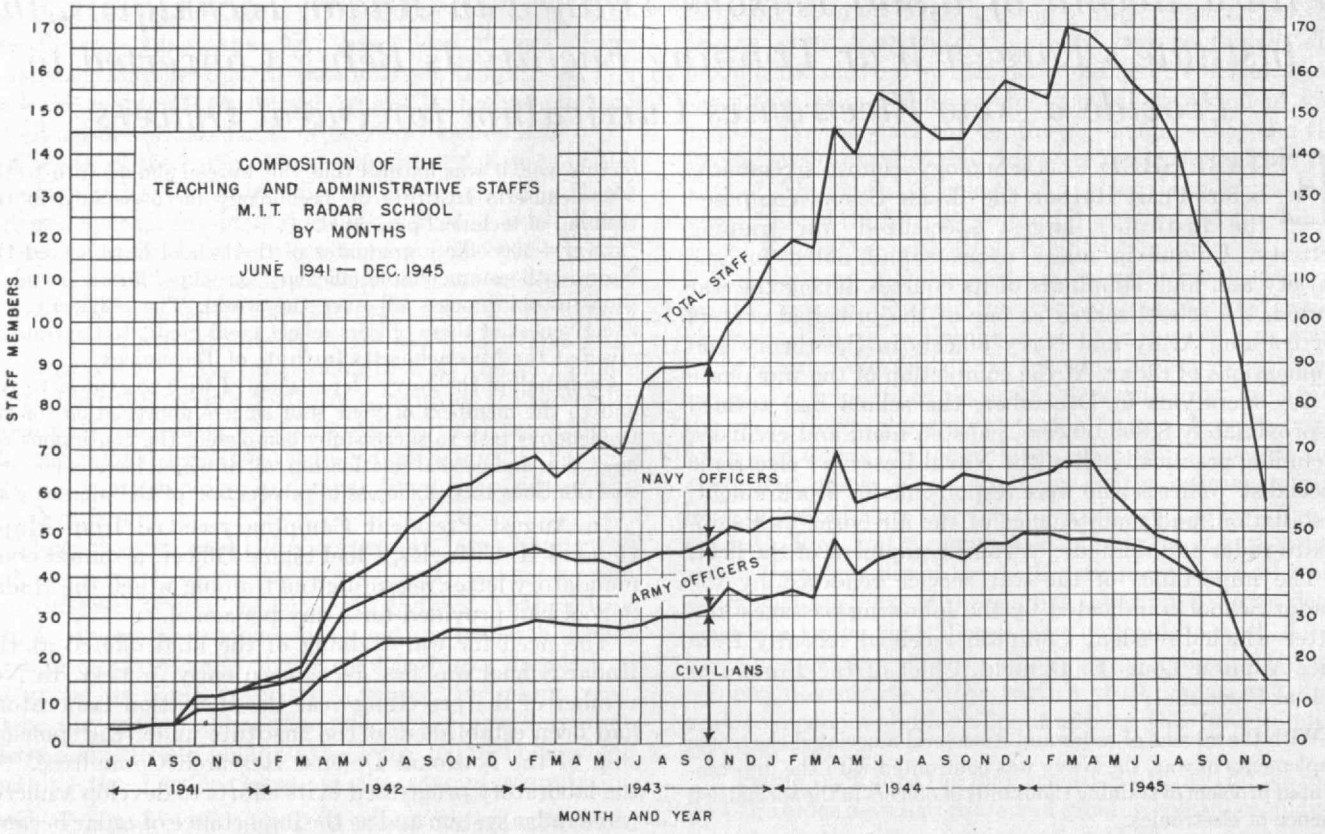
The need for war training of the kind offered at the Radar School was first recognized early in 1941. In November of the preceding year the Radiation Laboratory had been established at the Institute under the sponsorship of the National Defense Research Committee.[1] As the laboratory progressed in its efforts to develop a microwave radar system and as the importance of radar became

[1] See "Expanded Horizons," by L. A. duBridge and L. N. Ridenour, in The Review for November, 1945, p. 23.

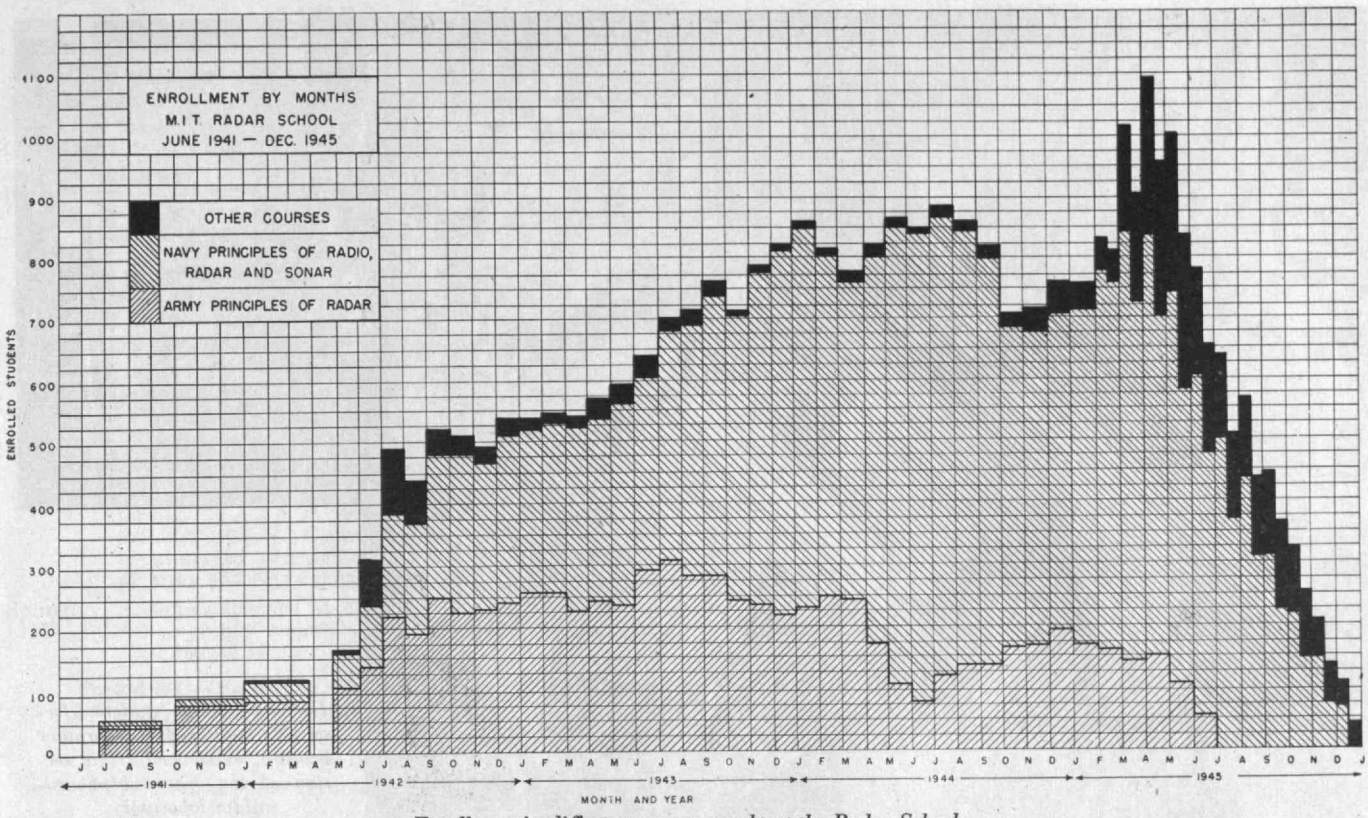


Particularly in the early phases of the Radar School, prototype microwave radar systems, assembled from development equipment of the Radiation Laboratory, were used in teaching basic radar principles.

increasingly apparent from British war experiences, it was realized that in the event of war our armed services would need many officers well trained in the basic principles and techniques of ultrahigh-frequency and microwave radar systems. In the spring of 1941, Professor Edward L. Bowles, '22, of the Department of Electrical Engineering, who was then secretary of the N.D.R.C. microwave committee, discussed this need with Dr. Compton, who agreed that the Institute should offer to provide the special radar training which the Army and Navy would probably require. The Institute was well prepared to offer such training not only because it was host to the Radiation Laboratory but also because of the considerable teaching and research experience in the ultrahigh-frequency field which members of the Department of Electrical Engineering already had.



Teaching staff of the Radar School during the war was composed of civilians, a fairly constant number of Army officers, and a widely varying number of Navy officers.



Enrollment in different courses taught at the Radar School

Accordingly, in May, 1941, Edward L. Moreland, '07, Dean of Engineering at the Institute, and Professor Bowles conferred with representatives of the Army and Navy. It was agreed that a selected group of officers should be given thorough training in the fundamentals of radar. These officers would be prepared to master future microwave radar equipment and to instruct other personnel in the principles and techniques of the art. This conference led to establishment of the training activity which later became known as the M.I.T. Radar School.

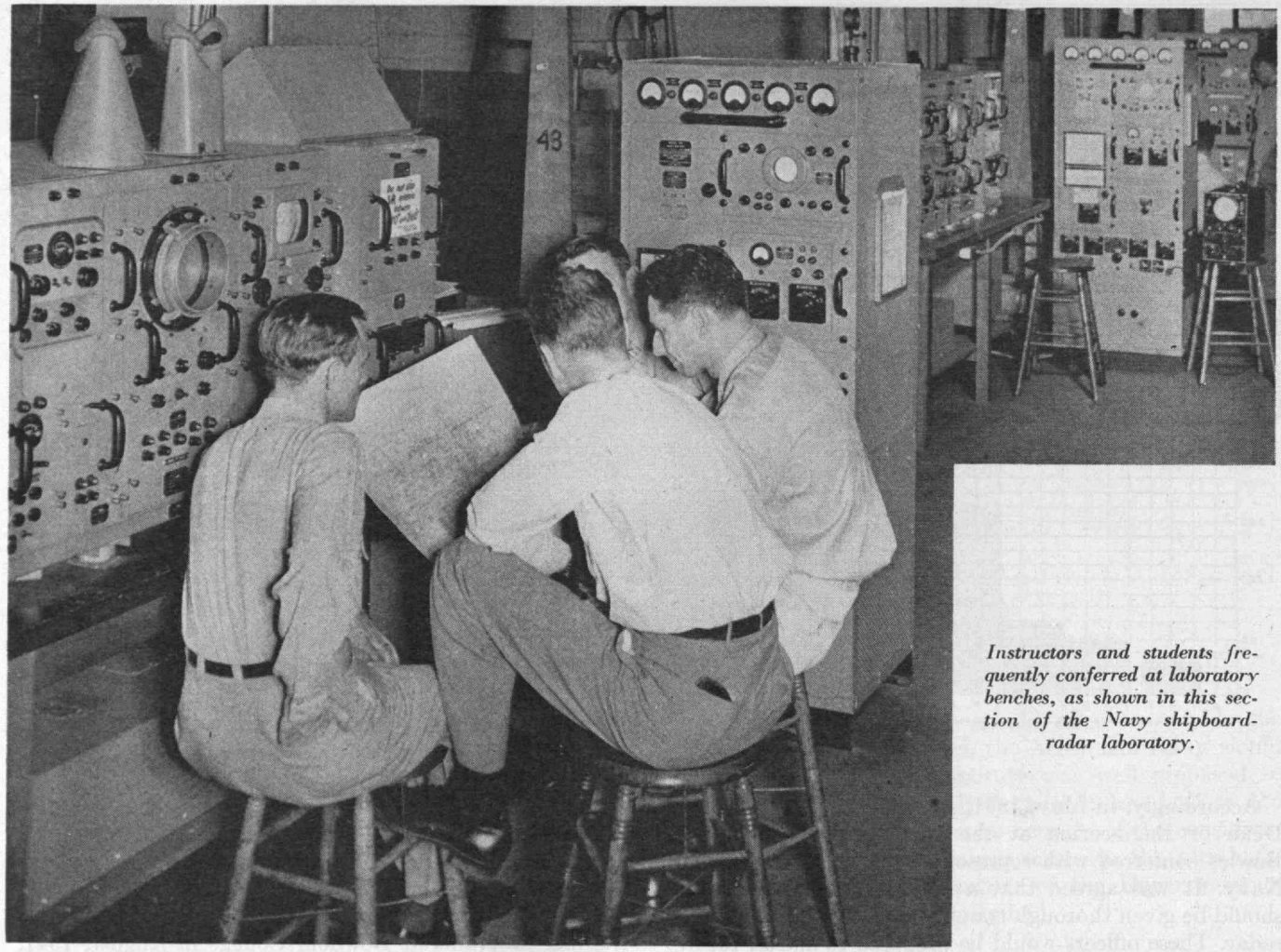
The first course began on June 23, 1941, and was attended by 44 Army officers and 14 Navy officers. This full-time course was of 12 weeks' duration and included a brief review of radio fundamentals followed by intensive instruction in the principles of radar and their specific applications in two representative systems: a microwave (10 centimeter) air-borne interceptions system, then under development in the Radiation Laboratory, and a long-wave (1.5 meter) searchlight control set, known as the SCR-268, which had been developed by the Signal Corps. Instruction on unclassified topics was given in regular Institute classrooms and in the communications laboratories. The radar instruction, which was classified "secret," was given within a heavily guarded area in Building 32, a temporary building on Vassar Street, west of the Institute's main group of structures.

In June of 1941 Harvard University offered to assist the Army and Navy by establishing special courses in electronics for members of the armed services. Conferences were held among representatives of the Army, Navy, Harvard, and the Institute, and it was agreed to establish a co-ordinated program under which officers selected for radar training at the Institute would first receive preparatory instruction at Harvard. Accordingly, a special full-time pre-radar course, dealing with nonclassified applications of electronics and radio, was established in the Harvard Graduate School of Engineering, and the first class entered on July 17, 1941. Originally of 10 weeks' duration, this course was soon lengthened to three months and later to four and five months for some groups.

Subsequently the Navy set up additional pre-radar training programs at Bowdoin College in August, 1941, and at Princeton University in June, 1943. The Harvard and Princeton pre-radar schools were continued until the summer of 1945, and the Bowdoin program was terminated soon after the end of the war. There was close liaison between the Institute Radar School and the pre-radar schools. Curriculum co-ordination conferences were held frequently, and every effort was made to give the students the best possible preparation for studying radar. The uniformity and effectiveness of the preparation given by the pre-radar schools greatly eased the task of the Radar School and was an important factor in the success of the entire training program.

Beginning with the second class, which entered in October, 1941, practically all of the Army and Navy officers who entered the Radar School were graduates of one of the pre-radar schools. Having better prepared students, the school was able to eliminate the review of radio fundamentals included in the first course and to give increased emphasis to radar principles and applications. Both the second and third classes, which started in January, 1942, received all of their training in Building 32, where the school occupied a total floor area of 9,000 square feet.

At the request of the Army and Navy early in 1942 plans were laid for a considerable expansion of the Radar School. New quarters were obtained on the upper floors and roof of the Harbor Building, an industrial type of building at 470 Atlantic Avenue, Boston; the staff was enlarged, and other essential facilities and services were provided to establish a secured and self-contained school



Instructors and students frequently conferred at laboratory benches, as shown in this section of the Navy shipboard-radar laboratory.

capable of accommodating 500 or more full-time students. In its new site, overlooking Boston Harbor and the airport, the school had ready access to many interesting radar targets. Operations at the Harbor Building started on May 4, 1942, marking the beginning of the second important period in the history of the school. Highlights of this period, as well as of the initial period of operation in Building 32 and the final period from February 1, 1944, until December 15, 1945, are summarized in Table I.

After the school moved to the Harbor Building, classes entered on the first weekday of each month, and the student population grew rapidly. The increase of personnel and the enrollment by months are shown on page 229. The enrollment exceeded 500 for many months (December, 1942, until August 15, 1945) and reached a peak of 1,094 in April, 1945.

Throughout the second period of operation the courses for Army and Navy officers were of three months' duration and comprised a common "basic course" followed by a program of special instruction for each group. The basic course covered the fundamental principles of radar and their applications in certain prototype microwave systems which had been developed by the Radiation Laboratory. After a class completed the basic course, Army and Navy officers were separated, and each group studied specific production radars currently important to its branch of the service. During the year ending May 1, 1943, the basic course was two months long. Thereafter, both the Army and Navy supplied the school with more and more standard production radars. The basic course was shortened, prototype equipment received less attention, and there was increased emphasis on service radars. During the latter half of 1943, considerable specialization was provided for Army officers of the Signal Corps, Air Forces, and Coast Artillery Corps and for Navy engineering, ordnance, and aviation officers.

The beginning of the third period of operation in February, 1944, was marked by the inauguration of completely separate courses for Army and Navy groups and by a further increase in specialization for the various service branches. During the third period, curricula were frequently revised to keep the instruction abreast of the rapidly advancing radar art. To permit adequate coverage of the large number of systems which the Navy officers had to know, it became necessary on April 1, 1944, to lengthen their courses to four months. In October the course for engineering (shipboard) officers was further extended to four and one-half months, and in January, 1945, there was a similar extension for the aviation officers.

The numerous course changes and extensions during the second and third periods of operation necessitated repeated expansions of school facilities. By March, 1944, the space occupied in the Harbor Building approximated 100,000 square feet and included all of the roof, 14th, 13th, 12th, and 10th floors, two-thirds of the 11th floor, and a portion of the second floor. By the spring of 1943 an annex had been established at Briggs Field for instruction on Army ground radar systems. In April, 1944, a second annex was opened near Kenmore Square, Boston, for

TABLE I
HIGHLIGHTS IN HISTORY OF RADAR SCHOOL

Period I — June, 1941, to April, 1942

6–23–41	First class of 58 officers started special full-time 12-week course.
7–17–41	Pre-radar training inaugurated at Harvard University.
10– 1–41	Improved 12-week course started for second class of 97 officers. Repeated for third class of 115 officers who entered 12–29–41.
	Operation in M.I.T. Building 32 (9,000 sq. ft.). Laboratory equipped with microwave prototype equipment borrowed from Radiation Laboratory.

Period II — May, 1942, to January, 1944

5– 4–42	School moved to larger quarters (36,000 sq. ft.) on roof, 14th, 13th, and 12th floors of Harbor Building at 470 Atlantic Avenue, Boston.
	New three-month course including interval of basic instruction for all students followed by separate programs for Army and Navy officers. Some specialization for Sig. C., A.A.F., C.A.C., and Navy engineering and aviation officers. Classes entered monthly. Marked trend toward increased emphasis on production models of Army and Navy radar sets.
Spring, 1943	Annex established at Briggs Field for instruction on Army ground radars. Additional space occupied on 12th floor of Harbor Building.

Period III — February, 1944, to December, 1945

2– 1–44	Separate courses established for Army and Navy with increased specialization for various branches. Prototype radars wholly replaced by service models.
3– 1–44	Additional space occupied on 10th and 11th floors of Harbor Building.
4– 1–44	Courses for all Navy officers lengthened to four months. Annex established at 19 Deerfield Street, Boston, for instruction in radar countermeasures. Instruction on Navy aviation radio begun at Harbor Building.
5– 1–44	Sonar instruction for Navy engineering officers established in new annex at M.I.T. Building 18, increasing total school floor area to approximately 120,000 sq. ft.
10– 1–44	Course for Navy engineering officers lengthened to 4½ months.
	Numerous special courses offered including 3-month course for A.A.F. Weather Wing officers, 2-month refresher courses for Navy officers, and 1-month maintenance course for Navy destroyer officers.
1– 1–45	Course for Navy aviation officers lengthened to 4½ months. Navy sonar training barge located in Charles River Basin.
6–29–45	Army war training program completed.
12–15–45	Navy war training program completed.

Period IV — January 1946

1– 1–46	New electrical engineering curriculum established for Navy officers specializing in electronics.

TABLE II
SUMMARY OF PERSONNEL TRAINED
June, 1941, to December, 1945

Course	Officers	Enlisted Men	Civilians	Total
Army, regular	2,549*	24	3	2,576
Army, special	56	3		59
Navy, regular	4,951†		7	4,958
Navy, special	695	227	82	1,004
Radiation Laboratory ‡			265	265
Total	8,251	254	357	8,862

* Includes 6 Royal Air Force and 17 Royal Canadian Air Force officers.

† Includes United States Coast Guard Reserve, United States Marine Corps Reserve, and 4 Allied officers.

‡ Radiation Laboratory staff members who completed the basic course between May, 1942, and December, 1943.

instruction in radar countermeasures, and in May a third annex was established at the Institute's Building 18 for instruction in sonar,[2] bringing the total school floor area to approximately 120,000 square feet. The final major addition to the school facilities was made in January, 1945, when a specially constructed sonar training barge was moored near the Technology Sailing Pavilion in the Charles River Basin.

The objectives of the principal courses of instruction for Army and Navy officers were fundamentally the same throughout the three periods of operation of the school, notwithstanding numerous changes in course content and shifts in emphasis. The primary objectives were always to give the student thorough instruction in the basic principles and techniques of radar and to teach him the applications of these principles and techniques in representative ultrahigh-frequency and microwave radar sets and related devices currently used in the field. Because of the phenomenally rapid development of radar and the increasing complexity and variety of the many sets produced, it was impossible to instruct the officers in the details and peculiarities of all sets which they would later encounter in the field. Thorough training of broad basic character was therefore essential.

Concentration on basic principles was particularly marked in the courses for Army officers. Although these courses did not cover radar maintenance practices, whenever suitable service sets were available in sufficient numbers they were used as teaching vehicles, with the Signal Corps, Army Air Forces, and Coast Artillery Corps groups specializing on the systems of particular importance to their respective branches. After completing their work at the Institute, practically all of the officers were assigned to Army schools for further training in the operation and maintenance of the specific types of radar sets which they were to encounter in the field.

Until the spring of 1944 many of the Navy officer graduates of the school likewise were assigned to Navy schools for a small amount of additional instruction in equipment maintenance. At that time, however, the Navy asked the Institute to add some maintenance instruction to the Radar School courses so that the officer graduates would be ready to proceed directly to their fleet and shore assignments. The courses for engineering and aviation officers were eventually lengthened to four and one-half months, and the two primary training objectives discussed above were supplemented by a third objective, namely, to give each student practice in the maintenance of equipment representative of that which he would normally encounter in the fleet.

Instructional methods at the Radar School were similar to those regularly employed in undergraduate courses at the Institute, although there was greater emphasis on laboratory work and more extensive utilization of charts, films, lantern slides, and other training aids. There were lectures, supervised study and problem periods, laboratory conferences, and examinations.

A student's daily schedule included several hours of lecture and supervised study and a three- or four-hour laboratory period. From 40 to 50 hours of instruction were scheduled each week. In addition, students were required to devote at least two evenings each week to preparation and review. For reasons of military security students and instructors were required to do all of their work within the guarded areas of the school. Classes were usually sectionalized to permit operation of laboratories during both morning and afternoon sessions and also to reduce the size of lecture groups. (*Continued on page 244*)

[2] Navy underwater sound equipment used in submarine warfare

Technology and Medicine

Modern Physical Technological Methods Initiate New Directions of Medical Research, Develop Better Instruments for Diagnosis and Therapy, and Open up New Careers

By Kurt S. Lion

HARDLY any other field of science is as misunderstood by the general public as that of medical research. Excessive dramatization is partly responsible for several popular misconceptions. Most common of these ideas is that the predominant number of advances in medicine begin with a man, sitting at a sick bed, utterly shaken by the effects of an incurable disease. Suddenly he has a new idea. He makes a few experiments, preferably on himself, which are successful. At first, no one believes in his work, but finally he is recognized and cures thousands of people.

Medical research does not follow such a course. Nor does a medical research center suddenly flourish into full bloom after a chance meeting has brought together a physician, a chemist, a physicist, and a financier who become united in their humanitarian collaboration by a burning desire to relieve the sufferings of humanity.

For the past 20 or 30 years chemistry has played an important role in medicine, whereas the participation of physics has been relatively limited. This condition is easily understandable. With the exploration of the chemical composition of and processes occurring within the body, a number of specifically acting compounds was found which could be used therapeutically. Not so in physics. The physical phenomena and forms of energy — particularly those employed in physical medicine — are mostly nonspecific, at least in the way in which they were used in the past. Another reason for the relatively small influence of physical sciences in medicine is simply that physics is too difficult. The physical phenomena in biology and medicine are for the most part so complicated that they have not yet been explored. The whole arsenal of physical research, from quantum theory to the technique of instruments of the highest sensitivity, is needed to investigate these problems. Without these powerful tools, any research in the biophysical field was formerly rather hopeless.

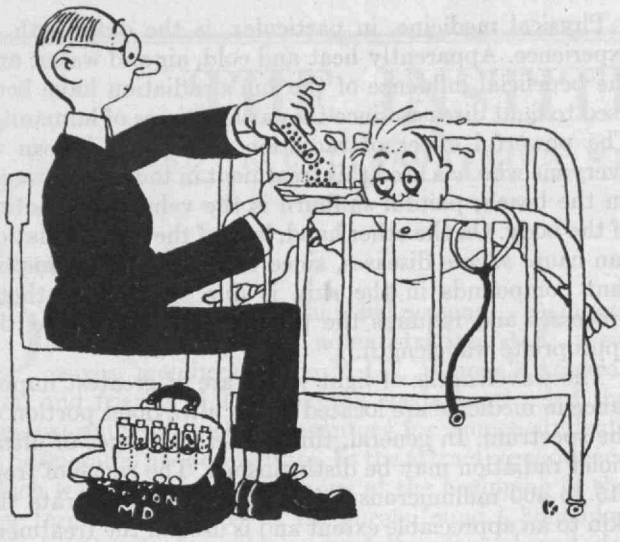
Already we have reached the point where a change of decided importance can be observed. The theoretical and technical means of this research are now available. The interest in, and therefore the number of articles and books about, subjects in physical medicine, biophysics, and medical physics has considerably increased of late. The war has stimulated important research in physiology as related to physical phenomena. There is much evidence of the desire to make the results of recent physical and technological investigations available for the service of biology, medicine, or public health. This tendency is manifested in the fields of electronics and instrumentation, in transportation engineering and air conditioning, in nuclear physics and, quite significantly, theoretical physics.

The introduction of physical and technological research into the medical field is very promising. Formerly, medicine had been developed on a highly empirical basis. Medical men were concerned merely with the over-all effects produced; a living organism such as a guinea pig would be treated in a specified manner, and the gross results of the treatment would be observed. The newer approach involves a quantitative study of the effects of the various physical phenomena acting upon the living organism and investigates step by step the results of these actions. Even though accurate physical measurements cannot yet be made on each and every aspect of the phenomena, the value of the approach is beyond question.

To illustrate this type of research, assume that we wish to study the medical effect of an x-ray treatment, applied to a given location of a tumor at a certain depth in the body. The treatment may be given under a great variety of conditions, using different x-ray generators, tubes, voltages, currents, filters, and distances between the generator and the subject. The biological results of such a treatment will be different in each case. But when we know enough about the absorption and scattering of x-rays in tissues and the effect of wavelengths and other physical magnitudes, we shall be able to predict the dose distribution in the body. Experimental results then become comparable, and the biological and medical results can be correlated with the physical phenomena causing them. At the same time, the number of variables involved diminishes greatly as will the number of opinions and contradictory reports so frequently encountered in medical literature.

The result of any kind of therapy is to be measured by the clinical success and the cure of the disease, of course. The process of healing a disease is, however, a consequence of a given treatment in addition to a great number of physiological and psychological processes. So long as consideration is restricted merely to the treatment and the cure, one does not know whether the patient got better because of, or in spite of, the treatment. In other words, the mere observation of the clinical end result is unsatisfactory because it is incomplete. Only that type of medical research which investigates the action of the treatment step by step will lead to the finding of natural laws which will always be valid and which, in the hands of the physician, will be a valuable guide to him.

This type of research also indicates how medical instruments should be fashioned so that better results may be obtained. For example, research on high-voltage x-rays has shown that it is possible to obtain an increase in x-ray energy in the depth of the body in such a way that the surface layers through which the beam passes are relatively little affected. This knowledge is of greatest



importance in the treatment of deep-seated tumors, and the development and production of appropriate equipment for clinical use follows as a logical consequence of such research. This single example is sufficient to show that physical and technological research may brilliantly complement clinical observation in furnishing the guiding principles for supplying medical men with new equipment.

Diagnostic Applications

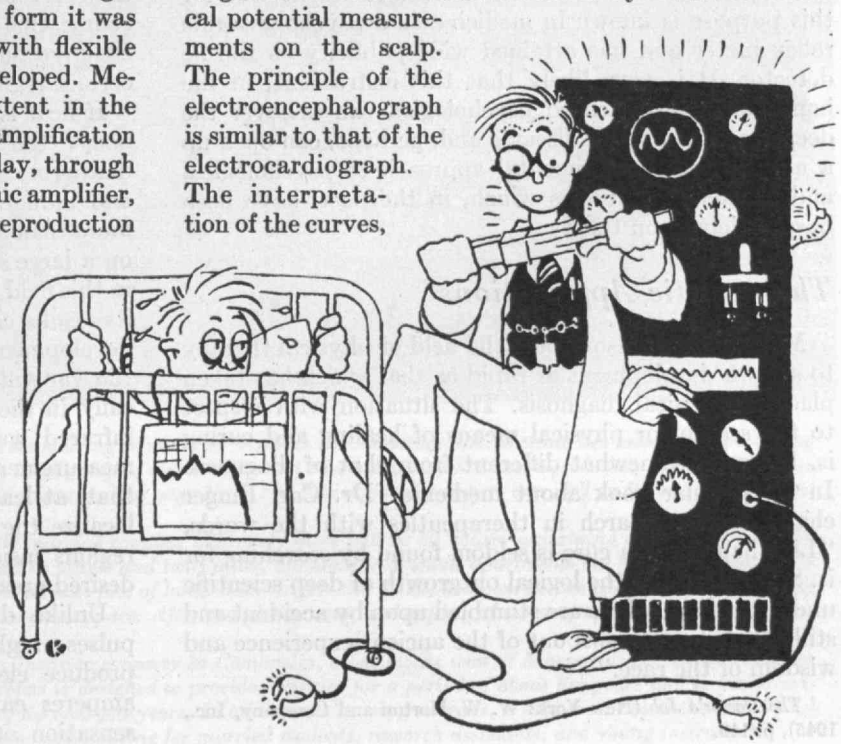
A great need for research and development may be anticipated in the field of physical diagnostic methods and instruments, and here again technological developments are able to make substantial contributions to medicine. One of the most commonly used instruments in the doctor's office, the stethoscope, belongs in the category of such physical diagnostic tools, and its development illustrates the benefits which modern technology can bring to the medical sciences.

When the stethoscope was first introduced into practical use in 1819 by René Laënnec, it consisted of a rigid hollow tube with enlarged end pieces. In this form it was used for a long time until the stethoscope with flexible tubing and a membrane at one end was developed. Mechanical resonance is employed to some extent in the flexible tubing stethoscope and provides some amplification over a narrow but useful frequency band. Today, through the use of a microphone and a suitable electronic amplifier, the electronic stethoscope makes possible the reproduction of the sounds of heartbeats for large audiences. At the same time, the instrument is able to record all aspects of systolic and diastolic contractions or, using filters, to select for special study any range of the frequency components of heartbeats. At present, the electronic stethoscope is used primarily for research, but there are other electronic instruments which have been adopted in standard routine examinations in medical practice.

Research on physical diagnostic methods and the development of instruments required for diagnosis are particularly promising at present through the use of electronic means. The complete lack of inertia in electronic equipment (at least so far as concerns the biological process to be measured), the ability to amplify, and the negligible amount of input power required to control electronic devices are, in part, reasons for the general anticipation of such a development. But biological considerations also contribute good reasons for the adoption of electronic equipment. Of these reasons, one of the foremost is that minute voltages, called action potentials, are produced within the body as a result of biological activity of the heart, brain, or nerves, for example. The amplification, detection, and analysis of these action potentials has opened up new fields of diagnosis which have reached their most advanced developments in the fields of electrocardiography and electroencephalography. Moreover, it has been found that the electrical characteristics of the skin may be used for diagnostic purposes, and here again electronic equipment is called upon to play its important role.

In electrocardiography the action potentials generated in the body as the result of the beating of the heart are obtained from electrodes placed on the arms, legs, or chest of the patient. These minute voltages are then amplified and recorded. A deviation of the recorded curves from the normal pattern indicates a pathological alteration of the heart activity. Since the patterns for different diseases are known, a reliable differential diagnosis is usually possible. It has also been proposed to use these action potentials for therapeutic purposes, as, for example, resuscitation or the treatment of cardiovascular diseases. Pick-up electrodes, from which the action potentials are obtained, are attached to the patient. After suitable amplification these potentials are reapplied to the patient by means of another pair of electrodes. By designing the amplifier for proper phase shift or delay of signals, it may be possible to stimulate the activity of the heart in its own rhythm. In this technique the heart is used as a self-excited oscillator. As yet, little is known about the results obtained with this method.

The electrical activity of the brain is recorded by means of the electroencephalograph, which makes possible the diagnosis of certain mental disorders by means of electrical potential measurements on the scalp. The principle of the electroencephalograph is similar to that of the electrocardiograph. The interpretation of the curves,



which are naturally much more complex than those of the electrocardiograph, is, however, sometimes difficult. Considering the very complicated processes of the brain activity, we would expect this, but the difficulty is a particular challenge to obtain more and better information by the use of improved equipment. With this method it is now possible to determine the location of a brain tumor (sometimes very important in brain surgery), and it may become feasible to localize or co-ordinate certain parts of the brain with some mental or physical anomalies. A considerable increase in the sensitivity of the instruments used in electroencephalography is not possible, however. The magnitude of brain action potentials is close to the noise level which it is impossible to overcome.

It is to be expected that further research on electric nerve action potentials in connection with other organs, glands, and so on, will evolve diagnostic methods which are perhaps of even greater importance in general medicine or in psychiatry than the ones we already have. The difficulties are great; what we measure is largely a superimposition of many different electrical signals. Sometimes the development of special experimental techniques is required to eliminate those signals which are not desired and to record undistorted the signals characteristic of the process under study. One difficulty here is the lack of a proper explanation of the fundamental process of propagation of nerve action potentials. The velocity with which an impulse travels along a nerve is of the order of one meter a second. This velocity is too fast for propagation to be achieved by purely chemical means; it is too slow to be the result of a purely electrical phenomenon.

The problem of physical diagnosis is frequently that of getting some information about processes going on inside the body from measurements on the body surface. Besides mechanical, thermal, or optical properties of the skin, its electrical properties can also be used diagnostically. From simple electrical resistance measurements of the skin one can get indications of the activity of the sympathetic nervous system and of emotional reactions of the person under observation. An instrument used for this purpose is known in medicine as a psycho-galvanic reflex meter and has attained wide publicity as the lie detector. It is very likely that this instrument, in the hands of an experienced psychologist, can uncover the deeper cause of many diseases and, perhaps, can open up a new physical experimental approach to psychological and neurological studies which, in the past, have been based solely upon theory.

Therapeutic Applications

Many persons also expect the field of physical therapy to show a development as rapid as that which has taken place in physical diagnosis. The situation with respect to the search for physical means of healing and curing is, however, somewhat different from that of diagnosis. In his popular book about medicine[1] Dr. Carl Binger characterizes research in therapeutics with the words, "Like happiness, a cure is seldom found by searching for it. Some cures are the logical outgrowth of deep scientific understanding, others are stumbled upon by accident and still others have grown out of the ancient experience and wisdom of the race."

[1] *The Doctor's Job* (New York: W. W. Norton and Company, Inc., 1945), p. 149.

Physical medicine, in particular, is the outgrowth of experience. Apparently heat and cold, air and water, and the beneficial influence of the sun's radiation have been used to fight diseases since the earliest times of humanity. The powerful effect of radiation therapy is known to everyone who has used this treatment in too large dosages on the beach; painful sunburn is the vehement reaction of the body. On the other hand, lack of the sun's radiation can cause severe diseases, since the formation of important compounds in the skin is due to photosynthetic processes and requires the presence of radiation of the appropriate wavelength.

The wavelengths of light which are of greatest importance in medicine are located in the ultraviolet portion of the spectrum. In general, three different ranges of ultraviolet radiation may be distinguished. The range of from 315 to 400 millimicrons has the power to penetrate the skin to an appreciable extent and is used in the treatment of some diseases, for instance, lupus. A second range of ultraviolet radiation, between 280 and 315 millimicrons, produces erythema of the human skin and is applied in the treatment of rachitis (rickets). The range of wavelengths shorter than 280 millimicrons has a particular germicidal effect. The primary effect of ultraviolet rays on cells or on proteins is still a difficult problem, especially since it is expected that the energy of a single photon of the radiation must have some relation to the binding energies within the structure of proteins.

Such specific effects are not to be expected in the infrared part of the spectrum. The effect of infrared treatment consists more of superficial heat, which may increase the flow of blood through the capillaries, relax muscle spasms, or produce locally increased metabolism. Frequently one finds the opinion expressed that infrared rays are able to penetrate into the depths of the body, but this is not so. Particularly those lamps used in infrared therapy which operate at low-color temperature (room heaters, for example) produce a radiation of which not more than a fraction of 1 per cent enters the skin. The waves longer than 1.4 microns are absorbed by oxyhemoglobin. Of course, this does not mean that infrared treatments are ineffective but rather that beneficial effects occur only in certain regions of the body.

If heat is to be applied into the deeper regions of the body, the techniques of diathermy and short-wave diathermy are more appropriate. Short-wave dielectric and induction heating have been used in medicine for more than a decade and have been employed by industry on a large scale for only a few years. Industrial research in this field has recently been so successful, however, that its results can now be used for medical applications. The development of ultrahigh-frequency equipment during the war will enable us to use electromagnetic waves medically in the range between very short radio waves and infrared waves. Theoretical considerations and actual measurements made on short-wave radiation fields show that, at least to some extent, it is certainly feasible to localize the effects of electromagnetic waves to certain regions inside the body by focusing the waves on the desired area or organ.

Unlike direct-current or low-frequency electric impulses, high-frequency voltages and currents do not produce electric shocks. At radio frequencies, several amperes can be sent through the body without any sensation other than that of (*Continued on page 256*)

THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

Housewarming

ON JANUARY 6 more than 200 persons — members of the Faculty and administrative staff, their wives, members of the M.I.T. Women's Association, and friends of Technology's coeds — attended the housewarming of the first dormitory for women students to be operated at the Institute. In the attractive residence which was opened for occupancy at the beginning of the new term on November 5, the guests found a homelike, uninstitutional atmosphere, carefully planned and designed to appeal to the young women students.

The purpose of the house is to provide a pleasant, economical place in which some of the Institute's increasing number of women students may live in an environment conducive to study and personal development. The Residence Advisory Board,* appointed by President Compton to develop plans for the new unit, believes that "experience in gracious living is an important part of a woman's preparation for effective personal and professional life and has made every effort to provide a suitable framework for such experience. All students accepted for residence in the house are expected to contribute to the fulfillment of these purposes. . . ."

The women students' house, purchased last summer by the Institute, is a four-story dwelling at 120 Bay State Road, Boston, about a mile from the main buildings of

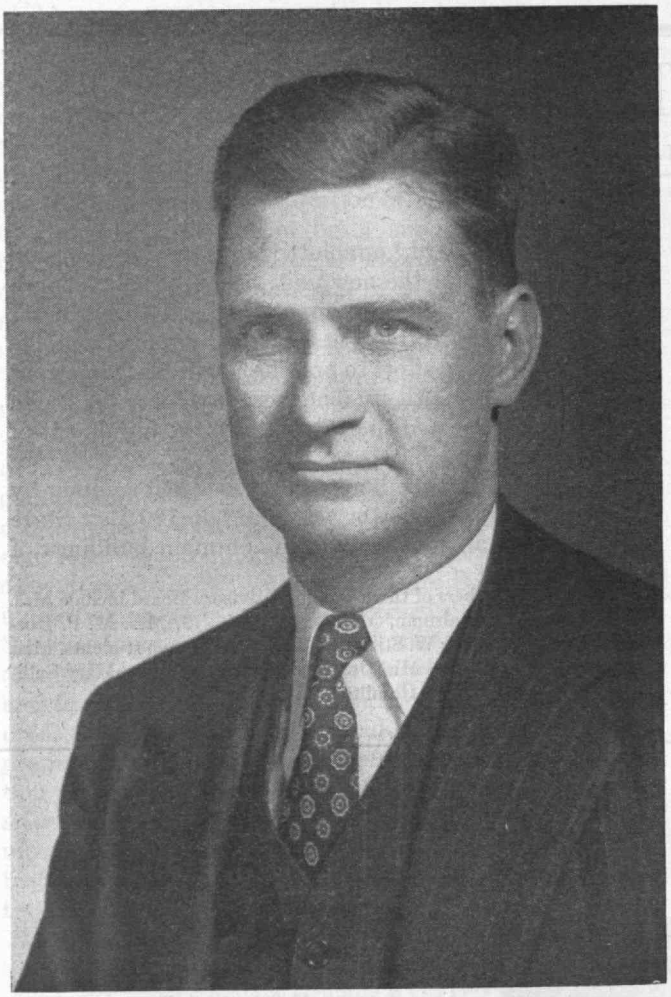
*Temporary members of the Residence Advisory Board include Mrs. Karl T. Compton, Chairman, Mrs. N. M. Sage, '13, Mrs. M. P. Horwood, '19, Miss Florence W. Stiles, '22, adviser to women students, Miss Margaret Whitcomb, '39, Miss Joan Rothwell, 6–45, Miss Mary Sullivan, 6–45, and Mrs. L. F. Hamilton.



Westgate Development. *In an attempt to alleviate the housing shortage for students in Cambridge, the Institute has taken the lead among colleges in providing housing facilities for the relatively large group of married students who are expected to return from their wartime activities for additional education at Technology. The program (announced on page 45 of The Review for November) was well on its way toward completion when this picture was taken late in December.*

In the Institute's program to provide homes for 100 married couples, ultimately there will be 50 houses containing one bedroom and 50 houses containing two bedrooms. The houses, arranged in single and twin units, are similar to small apartments but have the privacy of a house and the additional advantage that each house has its own plot of land. Both single- and double-bedroom houses contain combined living rooms and dining rooms, separate kitchens, and ample closet space. After completion and landscaping of the project, there will be adequate provisions for parking space for automobiles.

These houses are being built on the 10-acre plot on Institute property in Cambridge, a few blocks west of Massachusetts Avenue, between Memorial Drive and Vassar Street. The Westgate project is designed to provide facilities for a period of about five years and is aimed primarily to accommodate the large postwar enrollment of the next few years. In addition to housing veterans, Westgate will serve the added purpose of a study of the possibilities for future permanent housing for married students, research assistants, and young instructors.



Joseph J. Snyder, who took office as assistant treasurer of the Institute on January 1

the Institute, and may be reached conveniently by subway and surface lines. The house has been completely redecorated and furnished under the guidance of the enthusiastic members of the Residence Advisory Board, who faced the problem of equipping an entire housing unit under the restrictions of wartime shortages. In times like these, when it is difficult to obtain building materials, furnishings, and textiles, the committee did an excellent job in having the house in readiness for occupancy when the new term began on November 5.

The social rooms on the first floor include a reception hall, living room, dining room, and kitchen. There are four large double bedrooms with single beds, two smaller double bedrooms with double-deck beds, and two single rooms. Off the garden at ground level are a study hall and a completely outfitted laundry. Equipment for each occupant includes bed, mattress, pillow, three blankets, bed linen and towels, chest of drawers and mirror, desk and chair, bookcase, rug, and desk lamp.

Although the students get their own breakfast, a competent cook prepares dinner. The cost of the room and board has been kept as low as is consistent with wholesome living.

Mrs. Margaret Alvord, a graduate of the Boston Conservatory of Music and mother of four grown children, is housemother. With its piano, her room is a popular place for the students to gather after dinner to relax and listen to good music. A housewarming gift of a set of symphony records accentuates the need for a radio-phonograph for the house.

The new dormitory accommodates 14 of the Institute's 90 women students (70 of whom are candidates for degrees, the others being part-time students). In a sense, this unit is experimental, since the experience gained in its operation will undoubtedly play a major role when the time comes for building larger facilities for women students at Technology. Student self-government is in force. Each student cares for her own room and may reduce living expenses by helping with the cleaning of the general rooms of the house and by waiting on table.

The almost immediate amalgamation of a variety of unknown human beings into a commendable unity has produced among the first group of residents a harmony and high degree of co-operation which give character to the house and augurs well indeed for its future.

Assistant Treasurer

THE appointment of Joseph J. Snyder, Vice-president of the Railway and Light Securities Company of Boston and chairman of the board of the Michigan Seamless Tube Company, as assistant treasurer of the Institute has been announced by President Compton.

Mr. Snyder will be associated with Mr. Ford, Treasurer, who first joined the administrative staff of the Institute in 1914.

The Institute's assistant treasurer brings to his new post the advantages of wide experience in management and finance. His business affiliations include partnership in the Colonial Investment and Management Associates of Boston; he was vice-president of the Investment Service Corporation from 1934 to 1945. He has been financial adviser to Edwin S. Webster since 1934.

Mr. Snyder is the son of Mr. and Mrs. Paul J. Snyder of Findlay, Ohio, where he was born in 1907. He was graduated from the Carnegie Institute of Technology with the degree of bachelor of science in 1931 and from the Graduate School of Business Administration, Harvard University, with the degree of master of business administration in 1934. From 1943 to 1944 he carried on special graduate studies at the Institute. From 1944 to 1945 he was secretary of the budget committee and associate head of the Office of Business Administration of the Radiation Laboratory at the Institute.

Mr. Snyder was president of the Harvard Business School Alumni Association from 1943 to 1944. He is a member of the Detroit Club, and his fraternity is Beta Theta Pi. In 1937 he was married to Miss Helen T. Colburn of Wellesley. They have three children, and their home is in Weston, Mass.

Science Lectures

THE Society of Arts popular science lectures, discontinued during the war, have been resumed at the Institute in a winter series of Sunday afternoon talks, which began on December 16. The first lecture, "Microwaves in Radar," given by Ivan A. Getting, '33, Associate Professor of Electrical Engineering, was supplemented by demonstrations showing the characteristics of extremely short radio waves and their applications to radar.

The second lecture, on January 20, by John G. Trump, '33, Associate Professor of Electrical Engineering, en-

titled "The Acceleration of Electrons and Positive Ions by High Constant Potentials," illustrated the electrostatic method of generating a potential of several million volts for the acceleration of charged particles.

On March 3, Francis O. Schmitt, Head of the Institute's Department of Biology, will discuss "The Electron Microscope in Biological and Medical Research" and demonstrate the use of the electron microscope. Electron stains, surface replicas, stereoscopic micrographs, and electron shadowgraphs will be discussed in dealing with the techniques of electron microscopy.

The final lecture of the winter series will be given on March 24 by Gordon S. Brown, '31, Associate Professor of Electrical Engineering. Dr. Brown will discuss "The Servomechanism — Man's Mechanical Robot." The use and behavior of automatic control devices will be treated in a popular manner.

Appointed

CAPTAIN WILLIAM H. BURACKER, '30, U.S.N., has succeeded Captain Roswell H. Blair, U.S.N. (Retired) as professor of naval science and commanding officer of the Navy training schools at the Institute, with additional duty in connection with the curricula of the Navy postgraduate students.

Captain Buracker was graduated from the United States Naval Academy in 1919. In 1922 he was assigned to the Pensacola Naval Air Station for flight training and since then has performed duties both ashore and afloat as a member of the Naval Aeronautical Organization.

In 1928 Captain Buracker was assigned the postgraduate course in aeronautical engineering, which was completed at the Institute in 1930 when he was awarded his master's degree.

At the beginning of the war he was attached to the staff of Admiral Halsey as operations officer of a carrier task force in the Pacific. With Admiral Halsey he conducted the original carrier raids in the Pacific, including operations against the Marshall Islands, Wake, and Marcus. It was this task force which carried General Doolittle's aircraft for the first attack on Tokyo in the spring of 1942.

After the battle of Midway, Captain Buracker returned to this country to take command of the Naval Air Station at Pensacola. During the summer and fall of 1943 he studied in the first class of the Army and Navy Staff College with headquarters in Washington. Upon his graduation in October, 1943, he joined the staff of Admiral Nimitz as fleet aviation officer. Early in 1944 Captain Buracker was given command of the light carrier *Princeton* and served on her until October 24 of that year, when the ship was lost as a result of damage by Japanese aircraft during the Battle of Leyte Gulf. The *Princeton* operated as a unit of the fast carrier task forces, so-called Task Force 38 and 58, in actions against the Marshalls, the Marianas, Hollandia, the Ryukyus, Formosa, the Palaus, and the Philippines, participating in practically all actions in the Pacific during the period of the command without damage until the day the ship was lost.

Early in January, 1945, Captain Buracker was assigned to the staff of the Army and Navy Staff College in Washington and remained there until assuming his present duties at the Institute.



Captain William H. Buracker, '30, U.S.N., Professor of Naval Science and commanding officer of Navy training schools at the Institute

Sedgwick Laboratories of Sanitary Science

AS a consequence of the anticipated housing and construction engineering program to meet needs which are already acute, the Institute has made considerable enlargement during the past year in its program of sanitary engineering. A new program of instruction in sanitary science in the Department of Civil and Sanitary Engineering has been designed to meet the demand for engineers well trained in sanitary engineering and public health and to permit advanced students to specialize in sanitary science. Considerably greater emphasis than heretofore is placed on graduate instruction and research in the chemical and bacteriological aspects of sanitary engineering. At the same time, civil engineering students will be able to take more subjects in sanitary engineering.

To achieve the expanded program in sanitary engineering, the staff has been enlarged to include three men of professorial rank. In addition, new laboratories are being completed to permit members of the sanitary engineering staff to carry out important teaching and research work in various phases of sanitary engineering and public health. The program now being completed will enable the Institute to assume a leading position in the training of sanitary engineers with a good background in the sanitary sciences and public health. In addition, the revised curriculum will permit graduate students interested in san-

itary engineering to specialize in design, operational, or environmental phases of sanitary engineering and public health.

The Executive Committee has decided that the Sedgwick Fund may be used for laboratories to be known as the William Thompson Sedgwick Laboratories of Sanitary Science in honor of Professor Sedgwick, who was a pioneer in sanitary science and public health at the Institute. Professor Sedgwick is remembered with reverence by many graduates, particularly those of Courses VII and XI, because of his great ability as a teacher of sanitary science and public health.

Space has been allotted in the basement of Building 1, and construction of the new laboratories is now under way. The Sedgwick Laboratories will include: a laboratory of sanitary engineering to provide for illustrating principles of water and sewage treatment processed by laboratory scale units; a laboratory of sanitary chemistry for laboratory exercises essential to the teaching of sanitary chemistry and chemical analysis of water and sewage; a research laboratory for problems in water, sewage, and industrial waste treatments; and a laboratory of sanitary bacteriology for instruction and research in the applications of bacteriology to sanitation and public health.

The new program will be carried out by William E. Stanley, Professor of Sanitary Engineering, in charge of the division of sanitary engineering, Murray P. Horwood, '16, Professor of Sanitary Science, and Clair N. Sawyer, Associate Professor of Sanitary Chemistry. Professor Stanley will teach theory, practice, and design of water supply, sewerage, and water and sewage treatment; Dr. Horwood will teach sanitary bacteriology, principles of sanitary science, environmental sanitation, and public health administrative practices; and Dr. Sawyer will teach sanitary chemistry, chemical analysis of water and sewage, and sanitary engineering laboratory. Each of these men has had extensive professional experience in the fields of sanitary science.

Professor Stanley received the degree of bachelor of science in civil engineering from Kansas State College in 1912 and the degree of civil engineer from Purdue University in 1916. After a year of civil engineering experience he spent four years as instructor in hydraulics in the department of civil engineering at Purdue, during which time he spent the summers in professional engineering work in the Middle West. During World War I he was a captain in the Corps of Engineers and constructed hospitals in France. From 1919 to 1936 he associated with the firm of Pearse, Greeley and Hansen in Chicago as a consulting engineer on sanitary and hydraulic problems. He then spent five years at Cornell University as professor of sanitary engineering. During World War II as chief, sewerage and incineration, construction division, War Department, he was in charge of the design of sewerage works for camps and ordnance plants, and as major in the Corps of Engineers he served as water supply officer and later as chief of the construction branch, Headquarters Service of Supply, of the North African theater of operations. He came to the Institute in April, 1944.

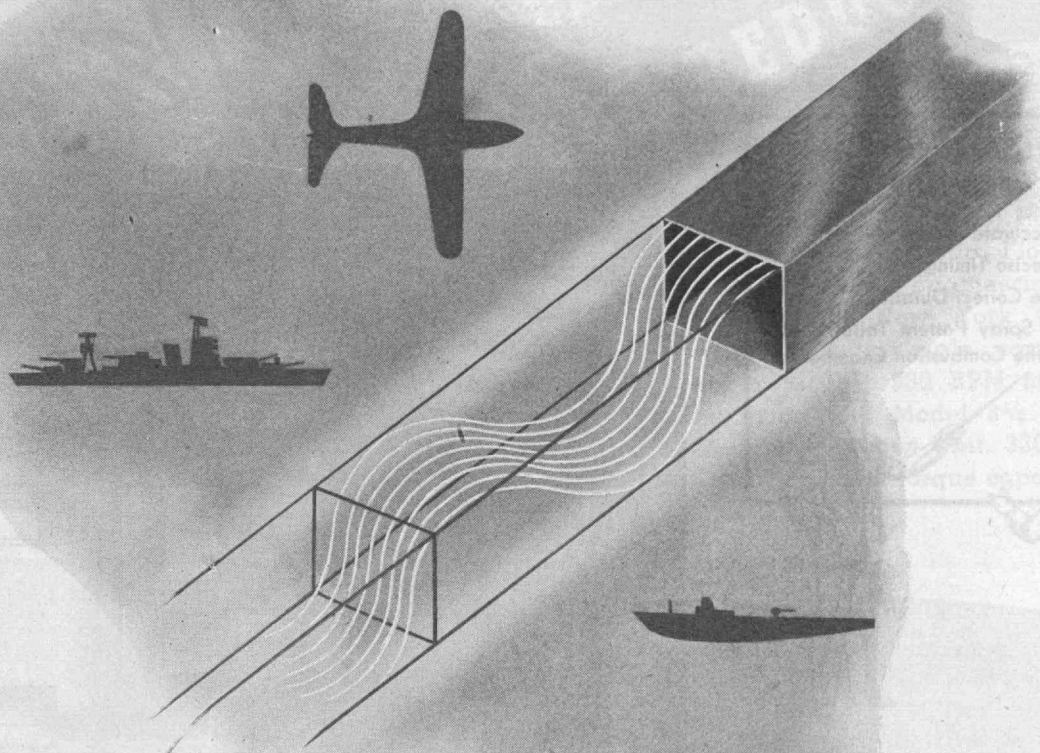
Dr. Horwood received the degree of bachelor of science from the College of the City of New York in 1913 and the degrees of master of science and doctor of philosophy in 1916 and 1921, respectively, from the Institute, where he was associated with the Department of Biology and Public Health from 1916 to 1944. In addition, he was instructor in sanitary and public health bacteriology at Wellesley College in 1917 and 1918, was in charge of bacteriology and public health at Boston University Medical School from 1919 to 1921, and for the following five years was in charge of public health at Tufts Medical College. Dr. Horwood has had varied professional experience since 1913, including his work as director of the Institute's food sanitation service (see The Review for November).

Dr. Sawyer received the degree of bachelor of science in chemistry in 1930 from the University of Wisconsin, where he remained until 1936 as instructor in chemistry. In that year he was awarded the master's degree from the University of Colorado. At the University of Wisconsin, from which he received the degree of doctor of philosophy in 1938, Dr. Sawyer was research assistant in the department of sanitary engineering from 1936 to 1938 and from 1938 to 1940 was postdoctorate fellow in the same department. From 1940 to 1942 he was assistant professor of sanitary chemistry and biology at New York University and from 1942 to 1944 was director of the lake fertilization and pollution survey at Madison, Wisc. Before taking up his duties at the Institute, Dr. Sawyer spent a year as special investigator in the operation of the Sioux Falls sewage plant for the South Dakota State Board of Health.

The Course in Sanitary Engineering was established at the Institute in 1891 and was operated on both undergraduate and graduate level as Course XI until February, 1944, when the undergraduate work was replaced by a group of elective sanitary engineering subjects in Course I, Civil Engineering. The educational program in sanitary engineering now includes undergraduate subjects as part of the Course in Civil Engineering and graduate subjects in sanitary engineering as Course XI. Those subjects which may be taken in the junior and senior years by students in the Department of Civil and Sanitary Engineering provide a limited training in sanitary engineering which should be highly useful to men intending to practice in those fields.

Twelve special subjects presently offered as graduate electives in Course XI for the training of sanitary engineers may be grouped into three categories: theory, design, and engineering practice; operational phases of sanitary facilities and stream sanitation; and environmental sanitation and public health. It is recommended that six specific subjects be required for students studying for the master's degree in Sanitary Engineering. These topics represent about one-half of the required credit hours. In addition, each student may select further subjects as he chooses so that if he wishes, he may specialize in design and engineering, in plant operation, or in environmental sanitation and public health.

The Institute has achieved a distinguished place in sanitary engineering because of the fundamental research performed in its sanitary laboratories. In the postwar period, considerable emphasis will be placed on the role of sanitation in promoting public health, and it will be necessary to expand the investigations in the broad field of sanitary engineering and sanitary science. The new Sedgwick Laboratories, properly integrated and staffed, will enable the Institute to continue to make important contributions in sanitation and public health.



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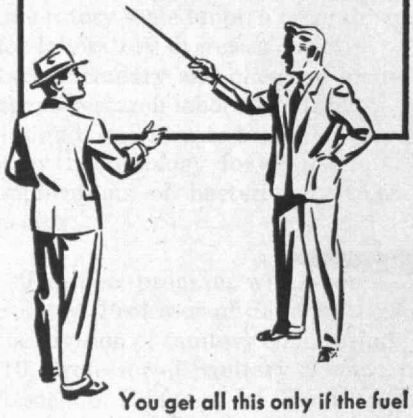
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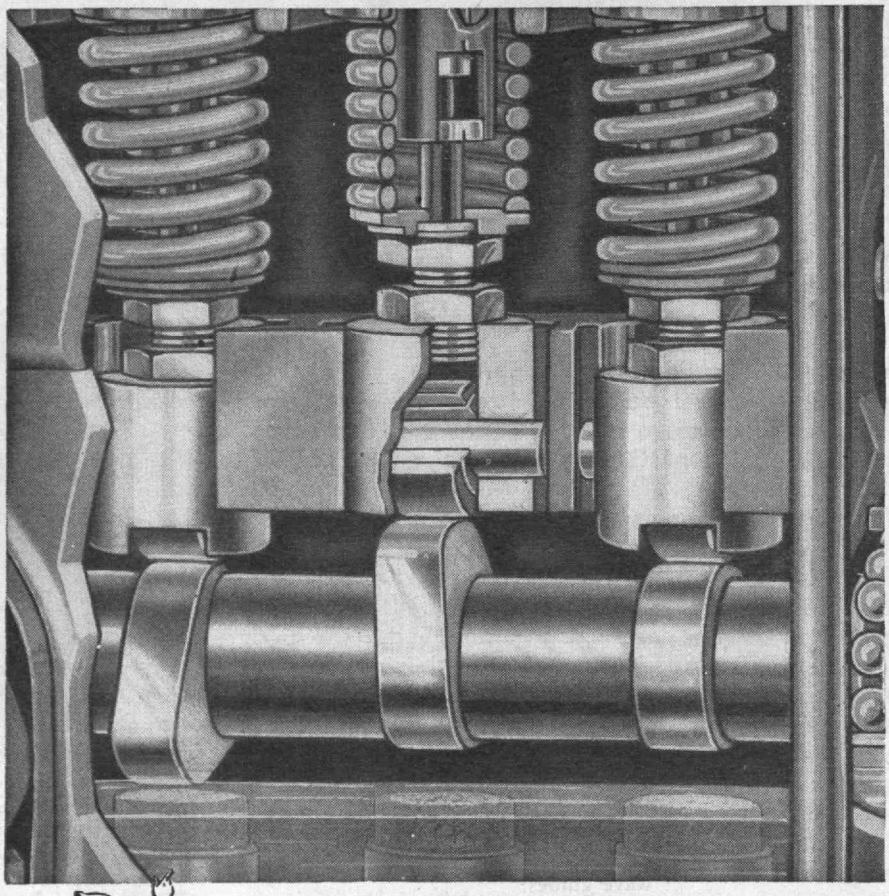
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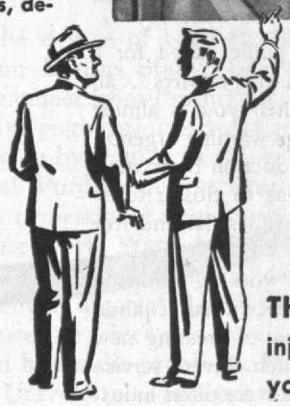


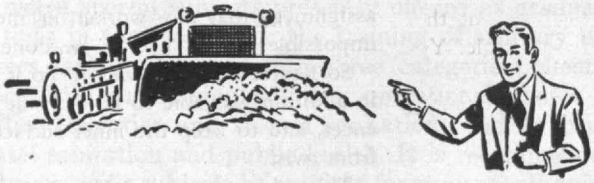
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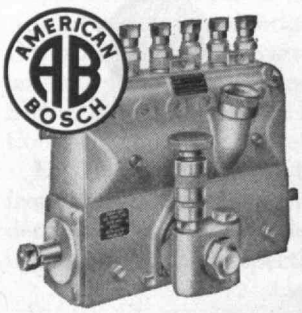
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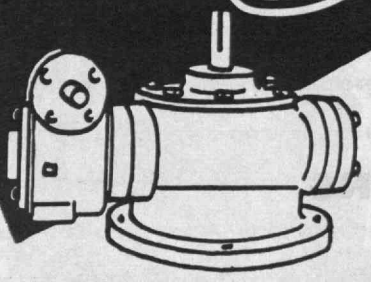


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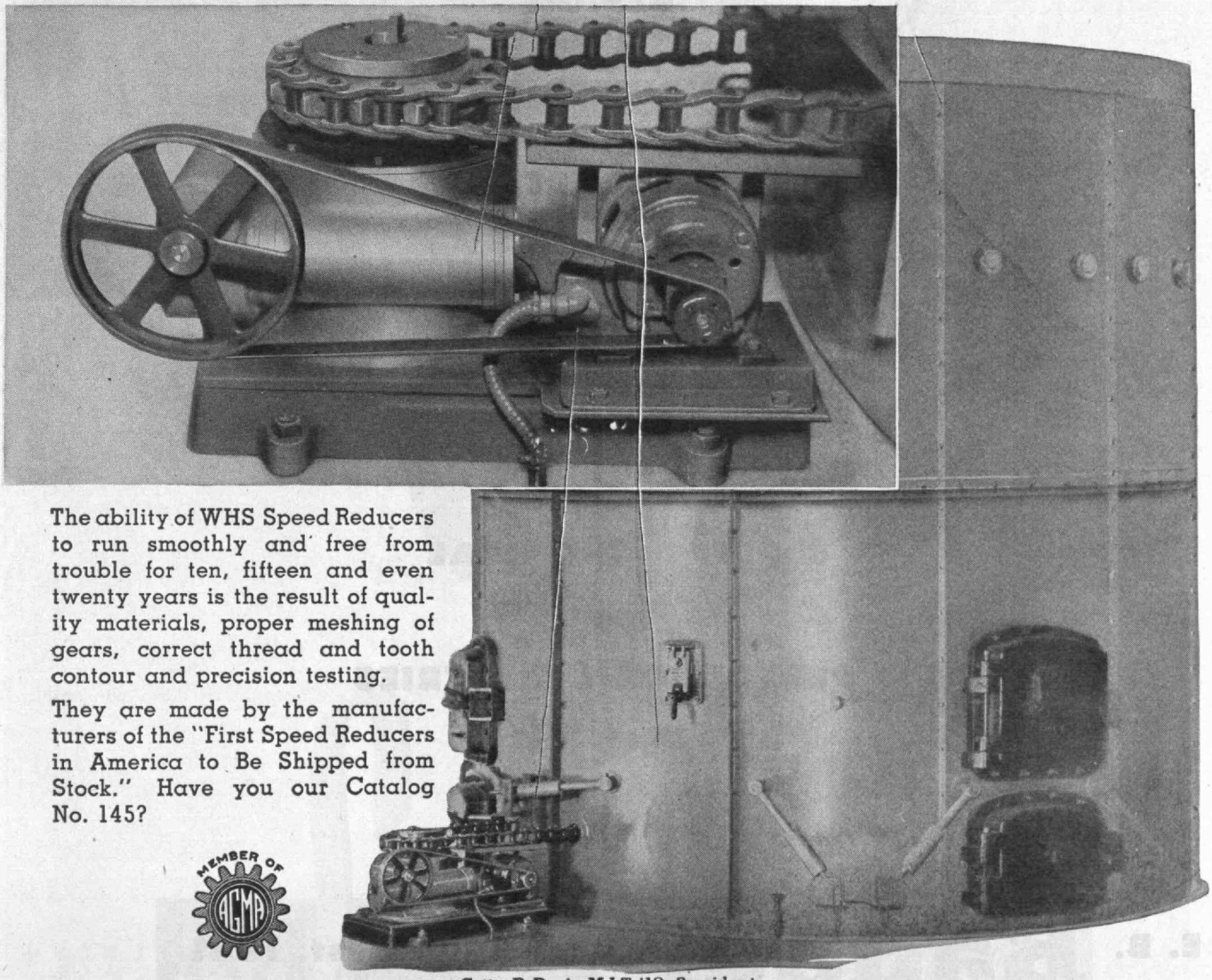
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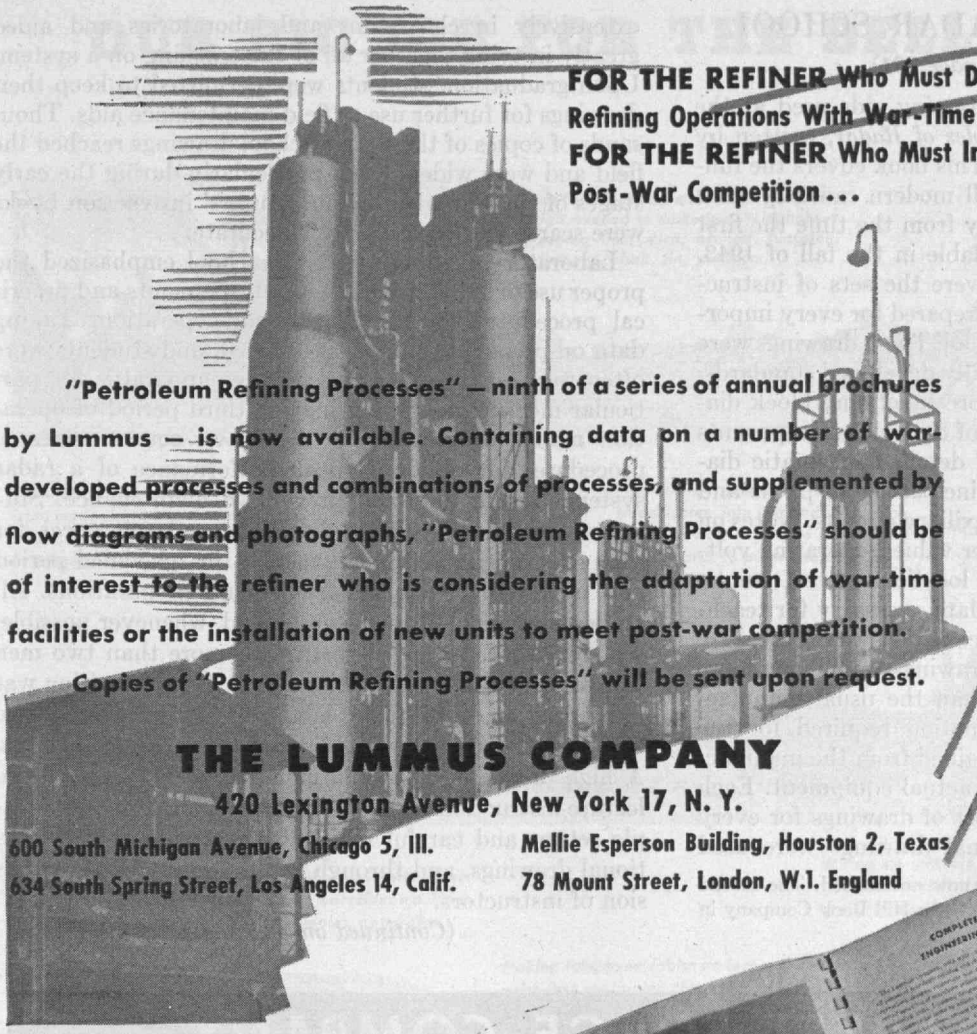
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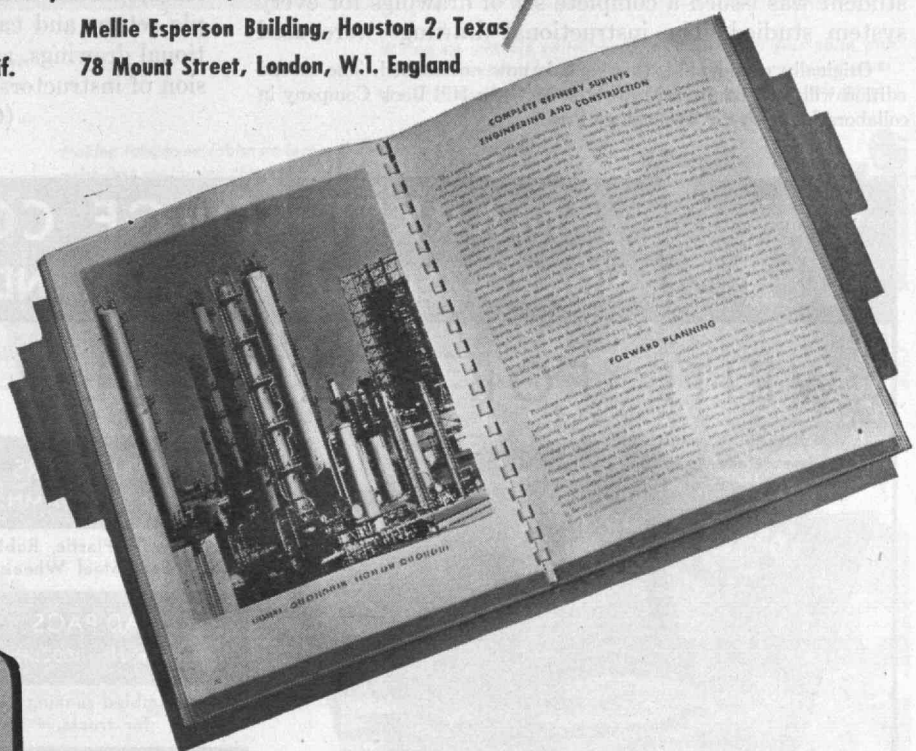
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TECHNOLOGY'S RADAR SCHOOL

(*Continued from page 231*)

One of the more important training aids used at the school was the textbook *Principles of Radar*, written by members of the teaching staff.[3] This book covers the fundamental principles on which all modern radar systems operate and was used extensively from the time the first preliminary copies became available in the fall of 1943. Other important training aids were the sets of instructional drawings which the staff prepared for every important radar system used at the school. These drawings were produced in accordance with locally developed standards, and each set included one or more functional block diagrams showing the relationships of the major components of the system and a number of detailed schematic diagrams prominently outlining principal signal paths and showing the connections of all auxiliary circuits. Notes on the diagrams indicated parameter values, operating voltages, tube types, part numbers, locations of test points, essential waveforms, and other data necessary for teaching the operation and maintenance of the system. Because of their distinctive style, these drawings were much more suitable for training purposes than the usual manufacturers' wiring diagrams. Information required for the preparation of drawings was obtained from the manufacturer and by close inspection of actual equipment. Each student was issued a complete set of drawings for every system studied. The instructional drawings were used extensively in classrooms and laboratories and aided greatly in tying together all of the teaching on a system. Upon graduation, students were permitted to keep their drawings for further use as field maintenance aids. Thousands of copies of the Radar School drawings reached the field and were widely used, particularly during the early stages of the war when manufacturers' instruction books were scarce and occasionally inaccurate.

Laboratory instruction at the school emphasized the proper use of standard measuring instruments and practical procedures for checking circuit operation. Taking data on prepared setups was avoided, and students were often required to select and arrange apparatus for particular measurements. During the third period of operation many experiments in the Navy courses stressed procedures for obtaining peak performance of a radar system, faultfinding, and preventive maintenance. Students were given printed directions and references for each experiment well in advance of the scheduled period and were required to make adequate preparations. All students were closely supervised, and, whenever possible, schedules were arranged so that no more than two men were assigned to a setup at one time. Report writing was minimized, and eventually laboratory grades were based largely on the results of individual practical examinations. A high degree of co-ordination between laboratory and lecture instruction was achieved through the use of multiple setups and careful scheduling, through the instructional drawings, and through rotation and close supervision of instructors.

(*Continued on page 246*)

[3] Originally confidential, this book is now unclassified. The second edition will soon be published by the McGraw-Hill Book Company in collaboration with the Technology Press.

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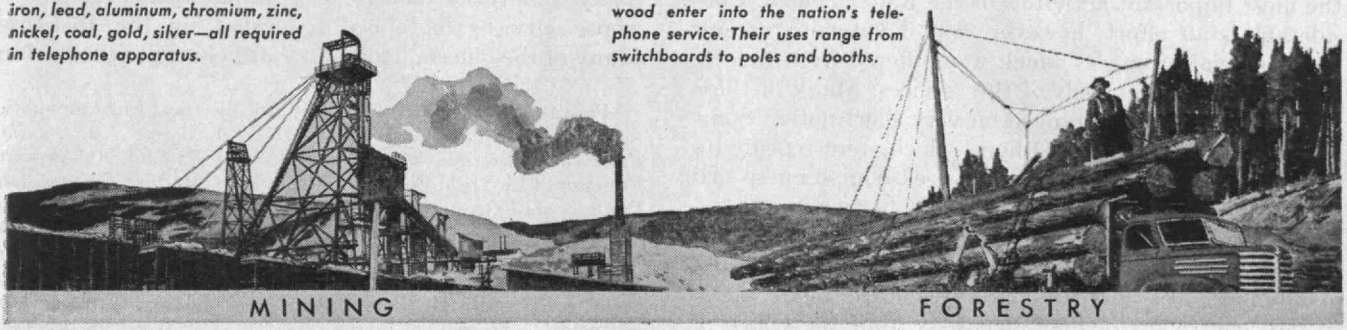
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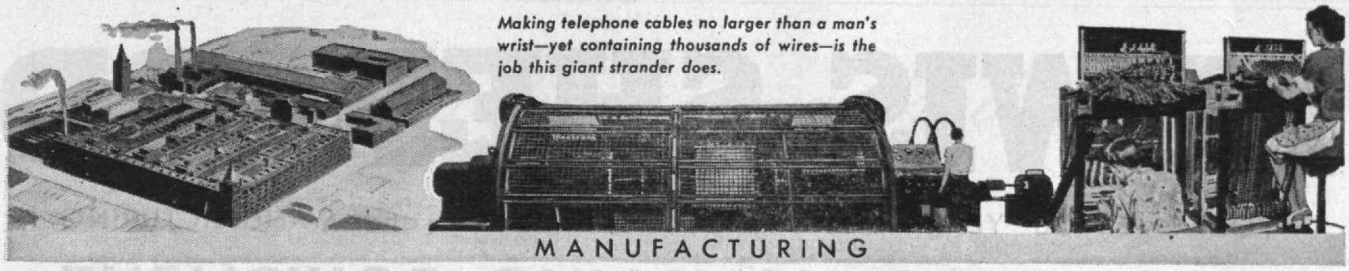
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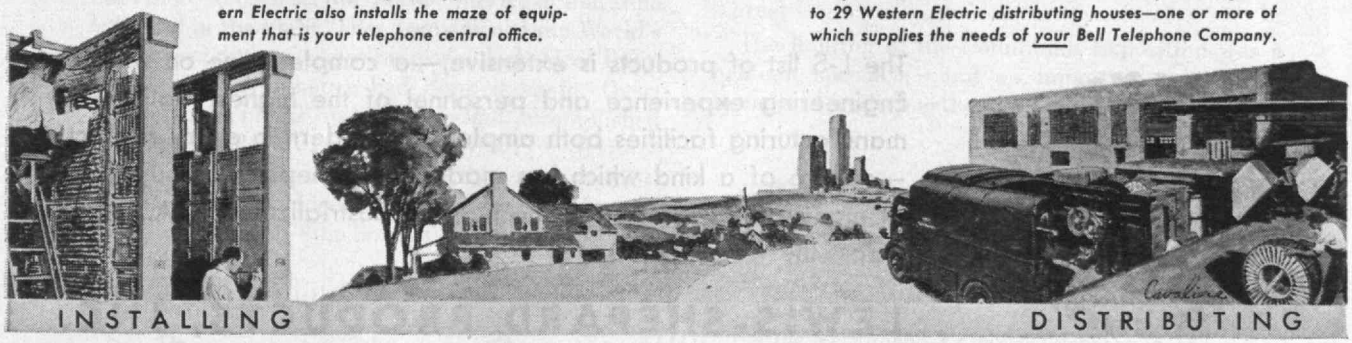


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TECHNOLOGY'S RADAR SCHOOL

(*Continued from page 244*)

During the early months of operation there were critical shortages of certain items of laboratory equipment, but later the school was well supplied with apparatus, especially during the third period of operation when Army and Navy radars and related test sets were being manufactured in great quantities. By the fall of 1944 the Navy had installed in the school laboratories one or more radar sets of nearly every type currently used by the fleet. These installations were kept up-to-date by making the usual field changes and were replaced by newer models when they became obsolete.

The full-time three-, four-, and four-and-one-half-month courses for Army and Navy officers were by far the most important activities of the Radar School. Considerable staff effort, however, was devoted to various short, special programs which were offered from time to time to fill specific needs of the services. Many of these special courses were arranged on very short notice. Some were offered only once. Others, which were repeated a number of times, included a 12-week course on special Navy air-borne electronic equipment, a two-month refresher course for Navy officers returned from fleet duty, a two-month advanced sonar course, a six-day course on maintenance of a new shipboard fire-control radar, and a six-day course for civilian scientists from the Office of Scientific Research and Development. In addition to these courses, the school also offered three subjects in radar included in M.I.T. graduate curricula which were arranged for selected officers from the Navy's Postgraduate School and the Army Air Forces. The total monthly enrollment in the special courses is shown by the chart on page 229. A summary of total personnel trained in both special and regular courses appears in Table II.

The teaching staff of the Radar School included civilians and Army and Navy officers. The composition and growth of the teaching and administrative staffs are shown on page 228. Owing to the character and variety of the courses offered and the need for detailed planning and supervision, it was necessary to maintain a low over-all ratio of students to instructors. The civilian instructors included members of the Department of Electrical Engineering,[4] staff members on leave from other colleges, engineers and physicists recruited from industry, and a number of recent Institute graduates. Almost all of the Army and Navy officers were Radar School graduates whose services had been requested by the Institute. Many of the officers had had radar field experience before

[4] Present members of the Department of Electrical Engineering who served were: Professor C. E. Tucker, '18; W. L. Barrow, '29, Associate Professor of Electrical Communications; W. H. Radford, '32, Associate Professor of Electrical Communications; M. S. McIlroy, '41, Assistant Professor of Electrical Engineering; G. T. Coate, '42, Assistant Professor of Engineering Electronics; H. J. Zimmermann, '42, assistant; L. W. Evans, '43, instructor; J. P. Chisholm, 2–44, assistant; L. D. Wilson, 2–44, research assistant; P. C. Grosse, 10–44, assistant; E. W. Keller, 10–44, assistant; B. H. Ciscel, research assistant; M. W. Essigmann, instructor; M. Loewenthal, research assistant; J. A. Wood, Jr., Assistant Professor of Electrical Engineering; and Patrick Youtz, research associate.

(*Continued on page 248*)

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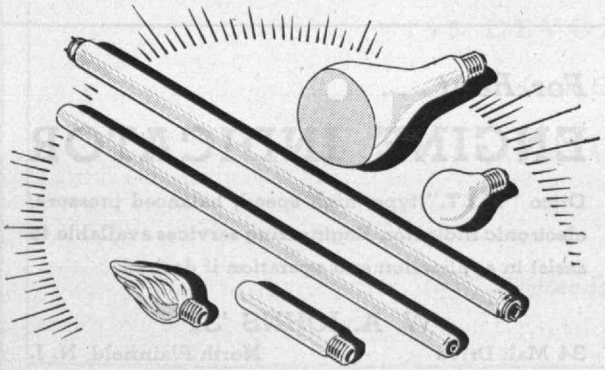
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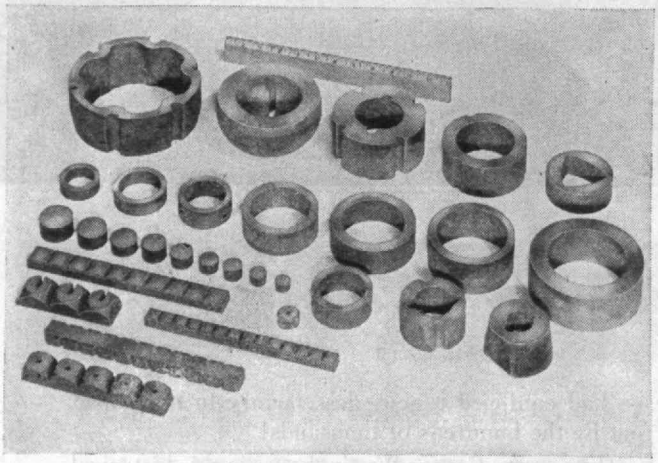
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TECHNOLOGY'S RADAR SCHOOL

(*Continued from page 246*)

reporting for duty as instructors. The constantly changing needs of the services required considerable rotation of officer instructors. The number of civilian instructors was kept as high as possible in order to promote continuity of instructional policies and to meet the expressed desires of the Army and Navy to minimize the number of officers required for teaching.

The administrative and teaching organizations of the school were modified from time to time as circumstances required. From the outset, however, the responsibilities for organizing and conducting the courses of instruction and for general operation of the school rested with a civilian director who was appointed by Dean Moreland. The senior naval officer at the Institute was in charge of all naval personnel and property assigned to the school. After April 24, 1942, the commanding officer of the Army Electronics Training Center (Harvard and M.I.T.) was in charge of all Army personnel and property at the school. Later, when the problems of naval administration had greatly increased, an officer in charge was assigned to the school.

W. L. Barrow, '29, Associate Professor of Electrical Communications, was director of the Radar School from June, 1941, until September, 1943. Professor C. E. Tucker, '18, has been director since that time. Others who served in the school administration are: W. H. Radford, '32, Associate Professor of Electrical Communications, as director in charge of instruction; H. J. Zimmermann, '42, as assistant director in charge of Army courses; J. A. Wood, Jr., Assistant Professor of Electrical Engineering, as assistant director in charge of Navy laboratories; S. K. Haynes as assistant director in charge of Navy lectures; M. S. McIlroy, '41, Assistant Professor of Electrical Engineering, as assistant director in charge of power and student records; and P. D. Appel, '22, as assistant director in charge of security and personnel. Commander J. L. Horning has been officer in charge for the Navy since May, 1944.

In addition to the large teaching and administrative staff, many other workers were required for operation of the school. The stringent security regulations required the school to function entirely within continuously guarded areas. It was required to operate as a self-contained unit and therefore needed its own guard force, secretarial staff, print shop, photographic service, schedules and records office, maintenance shops, purchasing department, and first-aid facilities. At the peak of ac-

(*Concluded on page 250*)

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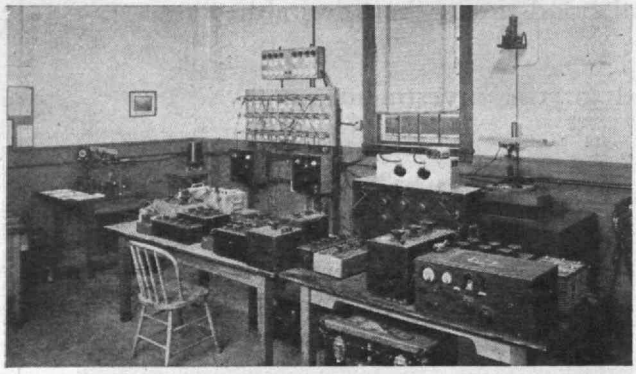
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TECHNOLOGY'S RADAR SCHOOL

(*Concluded from page 248*)

tivity, in the early summer of 1945, the service staff numbered 152 and included 36 guards, 25 janitors, 10 technicians, 32 secretaries, 20 print-shop clerks, 7 draftsmen, 1 lithographer, 1 nurse, and 20 enlisted personnel, including technicians, yeomen, storekeepers, and pharmacist's mates.

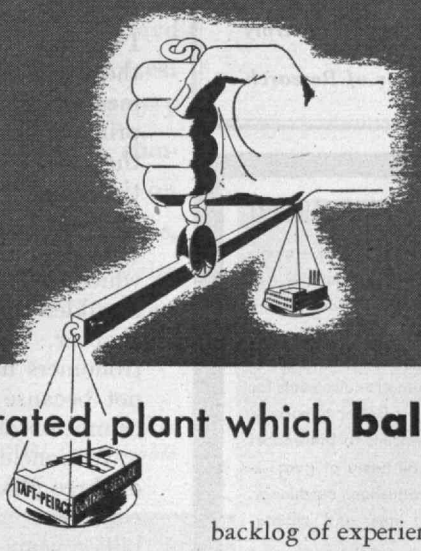
During the first two years of operation, substantially all expenses of the school were borne by the United States Office of Education under the national engineering war training program. After July 1, 1943, the school operated under government contracts, with the Army and Navy sharing operating costs in proportion to the number of students sponsored by each branch. The Army and Navy furnished all of the radar sets and much of the laboratory test equipment. The Navy also supplied all materials and labor for the installation of their equipment. While there was no official connection between the Radiation Laboratory and the Radar School, the laboratory assisted the school greatly, especially during the early years of operation, by lending prototype components of microwave radar systems and other apparatus and by furnishing essential technical information.

Many of the students at the Radar School expressed interest in postwar graduate study in the field of applied electronics, and it appears likely that a fair number will be admitted to the Institute for postwar study. The Institute has announced that it will grant a maximum of 24 "B" units of credit to any student who satisfactorily completed one of the regular three-, four-, or four-and-one-half-month courses at the Radar School.

The school is now being converted for postwar use and, starting with the 1946 spring term, will operate as a facility of the Department of Electrical Engineering. There will be laboratories and classrooms on the roof, 14th, and 12th floors of the Harbor Building and in Building 18 at the Institute. The school will continue under a Navy contract and initially will offer nine different electrical engineering subjects dealing with principles and applications of radio, radar, and sonar. All of these subjects will be classified and will be open only to officers and civilians designated by the Bureau of Naval Personnel. Most of these subjects are included in a new five-term curriculum in naval electronics which the Department of Electrical Engineering has arranged at the request of the Navy. This course leads to the degree of bachelor of science in electrical engineering and will be taken by selected graduates of the various Naval R.O.T.C. units. Some of the subjects offered at the Radar School will also be taken by officer graduate students from the Navy Postgraduate School and the Army Air Forces.

Naturally the Army and Navy officers as well as the civilians who served on the staff of the Radar School are proud of their part in the training of technical personnel during the war. They are equally proud that the Radar School has been selected to continue the higher level portions of its program in the era of peace. Probably no other act so aptly symbolizes the important role which radio, radar, and sonar are destined to play in this country's future as does the establishment of an educational center in which a nucleus of selected men will become trained in the instrumentalities for safeguarding this nation's security.

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THE AGE OF THE EARTH

(*Concluded from page 226*)

is plotted a qualitative curve of the history of volcanic activity and of earth heat. In the beginning, while the earth was gaseous, all earth was one vast volcano. During the liquid phase, the earth was one vast lava flow, and when the early crust formed, the earth had more and bigger volcanoes than ever since. So we must draw a curve of volcanism through the ages — an ever-flattening curve, as shown in Fig. 3 — for as the earth's crust thickened, volcanic activity diminished. But through all the 1,500,000,000 years of legible record we see no evidence that the earth's volcanic activity had lessened. The oldest lavas we can find are not bigger than those of the Age of Mammals. Even the Ice Age, wholly within the human period, saw the building and eruption of volcanoes that compare with any of which the earth has record. Indeed, all the active volcanoes of today are remnants, most of them dwarfed and dying, of the truly great volcanic action which culminated during the Ice Age.

As we try to peep through the curtain that hides the unrecorded era, our last glimpse of the oldest recorded volcanic action tells us that the earth was in much the same state then as now, and we may infer that much the same habits of volcanism had continued for a long time before the granite curtain closed.

Thus we recognize only two chapters of earth history, a hot-earth chapter and a cool-wet-earth chapter. Now if I try to figure out the true age of the earth, I begin with the excellent work of the chemists and physicists who measure the age of the oldest granites and give me a primary figure of 1,500,000,000 years, which I prophesy they will increase voluntarily in the near future. All this time lies wholly within the cool-wet chapter, and at that distant date, life was already old. Next must be added the unrecorded half of the cool-wet chapter, the duration of which is conservatively another billion years. Then must be added the wholly uncertain, but surely long, hot-earth chapter. The only estimates which mathematical astronomers have made of this chapter are unacceptable, not because their figures are at fault but because they cannot obtain the needed facts.

We conclude that the earth's history must be composed of three phases: the recent 1,500,000,000 years when the earth was in essentially its present form; a conjecturable billion years when the earth was in a transition from liquid to solid state; and a long era in which the earth was gaseous. The formula is indefinite, indeed, but the earth's age must approach 3,000,000,000 years. Although the figure is a guess, the order of magnitude is dictated by a vast array of significant facts and is likely to be too low rather than too high.

THE TREND OF AFFAIRS

(*Continued from page 222*)

mainly as an observing and experimental station and secondarily as a refuelling station for spaceships, and he wanted to place it as low as possible. It was to be just high enough so that it would not encounter atmospheric friction, and he named 1,000 kilometers as a figure.

(*Concluded on page 254*)

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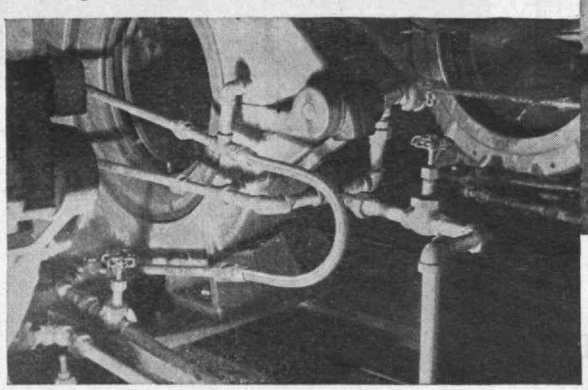
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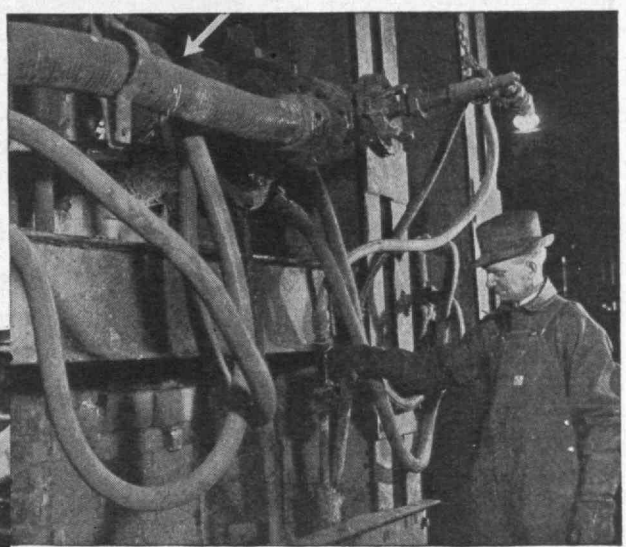
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THE TREND OF AFFAIRS

(Concluded from page 252)

A little later an Austrian engineer, Captain Potocnik, writing under the pen name of Wilhelm Noordung, advanced much more definite plans. His main objection to Oberth's placement was that a station only 1,000 kilometers from the surface would move rapidly with respect to the surface. Noordung calculated the distance so that the station would seem to be fixed above the earth's surface at about 26,300 miles. In reply to inconsistencies in Noordung's work, Count von Pirquet then evolved plans for two stations revolving at 470 and 3,100 miles from the surface, respectively, and connected by a so-called transit station traveling a more elliptical orbit, which was supposed to touch the other two. Since all this material was available in print,[1] it is hard to see how anybody could conceive of the space station as a great novelty which had to be dug up from secret German archives.

[1] Willy Ley, *Rockets* (New York: The Viking Press, 1944; 3d printing, 1945) pp. 220–247. (Contains a discussion of the work of Count von Pirquet which appeared originally in *Die Rakete*, the monthly journal of the German Rocket Society.

Hermann Noordung: *Das Problem der Befahrung des Weltraums* (Berlin, 1929). (Virtually the whole book is devoted to a discussion of the station in space.)

Hermann Oberth: *Die Rakete zu den Planetenräumen* (Munich, 1925, 2d edition), pp. 84–89.

Hermann Oberth, *Wege zur Raumschiffahrt* (Munich, 1929, 3d edition of preceding), pp. 350–371. (This book is now available as a photolithogravure reprint, Edwards Brothers, Inc., Ann Arbor, 1945.)

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TECHNOLOGY AND MEDICINE

(*Continued from page 234*)

heat. But direct current, direct-current pulses, and low frequencies are used in medicine. Recent research in shock therapy and also in the promising field of electronarcosis demonstrates the possibility of using electrical power of low frequency and various wave forms for specific purposes.

Among the great number of physical agents which are actually or potentially important in medicine, that of climatological environment is very interesting but may be rather problematic in its influence. Different authors report that some diseases, like arthritis and rheumatism, and certain psychological and physiological conditions depend upon the weather. Many people are affected by a change of atmospheric conditions, as, for instance, the arrival of a thunderstorm or a snowstorm, and such effects can be very pronounced, depending upon the geographic location. Since temperature, humidity, and barometric pressure do not appear to be involved in this effect, it has been claimed that the electrical condition of the atmosphere is the important factor. Russian workers report interesting progress in this field, but it seems that additional research is needed to reach definite conclusions. Medically important discoveries may result from further work in this field.

It has been said that physical therapy is a purely psychological treatment. Considering the decisive importance of psychology in medicine, no other statement could be of higher praise to physical therapy. The important question is only whether the effect of treatment with physical agents acts first in the imagination of the patient and from there acts upon his body or whether a physical or chemical change in the organism can be proven to be a direct consequence of the physical agent. We know today that both effects exist, but we do not know enough about the individual factors and how they interact. Fortunately, the physical and biophysical part of this complicated process is accessible to experimentation and exact measurement, and we may expect much progress from research in this field.

Education

In the future, the complexity of the physical phenomena involved in scientifically oriented investigations in physical medicine will require the services of trained physicists. Many hospitals have already recognized this fact and have added physicists to their staffs. Some have installed biophysical laboratories, analogous to the biochemical laboratories, which have long since proved their value. The tasks of a physicist in such a position are numerous. Besides his own research, often in collaboration with his medical colleagues, he works out plans for treatment in special cases (e.g., deep therapy); he develops physical methods for special diagnostic and therapeutic applications; he keeps the medical staff informed about progress in physical research; he teaches (particularly in medical schools) advanced and specialized courses; and he advises the medical research workers whenever they need physical methods and instruments in their own research. Inquiries for such physicists have already been received from hospitals, and the Institute has in operation

(*Concluded on page 258*)

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TECHNOLOGY AND MEDICINE

(*Concluded from page 256*)

plans for the training of physicists for the medical field. The training of physicists and engineers in this field will also be of interest to a number of industries, in particular those concerned with medical instrumentation. The anticipated expansion of this branch will require specialists, trained engineers, physicists, and biologists to an extent which perhaps may be comparable to the man-power requirements of the chemical pharmaceutical industries.

To establish an efficient liaison between physics and medicine it is not merely sufficient for the physicist to know more about medicine and biology. It is also necessary for the physician to apply the physical way of thinking to these problems and to acquire some knowledge of the available physical technological methods. The writer has repeatedly found that the physician, thinking in biological rather than physical terms, does not always appreciate the necessity of an objective physical dosimetric measurement. In short-wave diathermy, for instance, the subjective feeling of heat is frequently used as a criterion for dosage of the treatment and has been defended as "biological dosimetry," which was considered superior to "mechanistic physical dosimetry." It is obvious that such a biological dosimetry contains two unknown variables: the physical field intensity and the physiological sensitivity of the patient. Two treatments on patients of different sensitivities can give entirely different results, although both patients indicate the same biological dose. A better training of the physician in physics (either premedical or postgraduate) and an additional training in instrumentation for the specialist in physical medicine are necessary not only for the physical quantitative approach but also for a successful collaboration between physics and medicine.

The need for such a training has been recognized by the Baruch committee on physical medicine which has recently granted funds for the equipment of a physical medical laboratory to teach physicians the physical technological methods which are or can be applied in medicine and to develop and investigate such methods and instruments as may be most promising. This project is already in operation, but at the present time only a very limited number of applicants can be trained. The program offers a great opportunity for an intensive collaboration of physician and physicist from which may be expected new and better applications of physics and technology in medicine.

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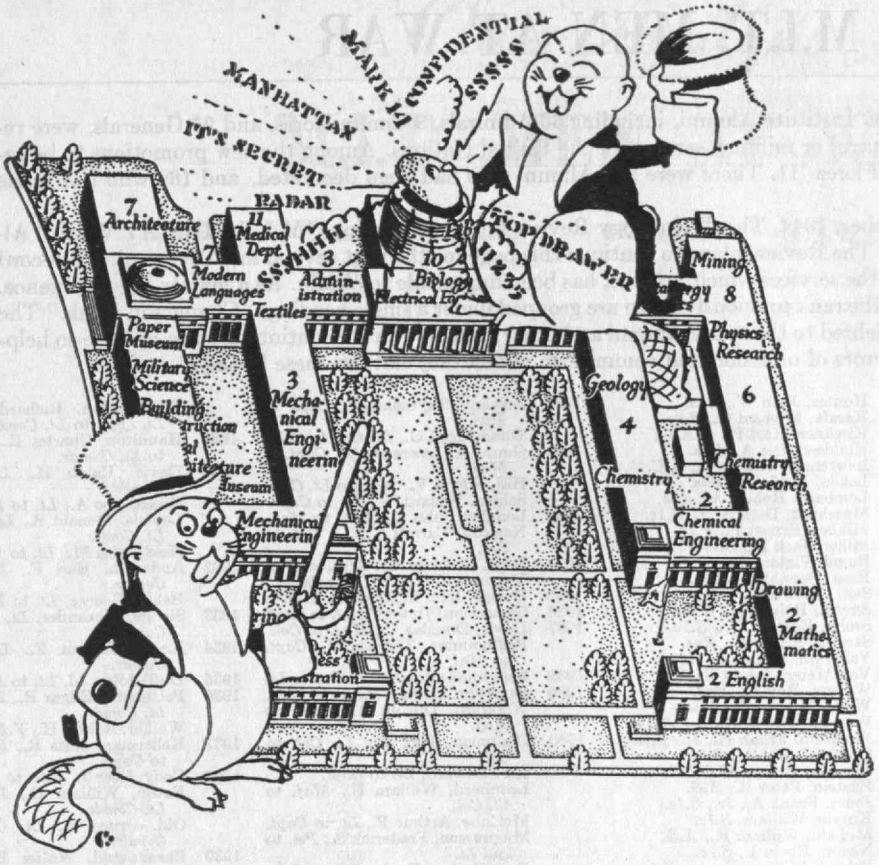
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TECHNOLOGY MEN IN ACTION

M.I.T. MEN AT WAR

Up to January 17 over 9,208 Institute Alumni, including 36 Admirals, 8 Commodores, and 95 Generals, were recorded as being in the active naval or military services of the United Nations. Among the new promotions to be reported is Rear Adm. Luis de Florez '11. There were 261 Alumni who had been decorated, and 162 who had made the supreme sacrifice.

With its issue dated November, 1942, The Technology Review began publishing "M.I.T. MEN AT WAR." Although hostilities have ended, The Review plans to continue this page for the next several months in order to record information on M.I.T. men in the services which, to date, has been impossible to obtain. As a matter of convenience, promotions and corrections in the rank previously given are grouped under a single heading, "Changes in Rank." The Review Editors are greatly indebted to the many Alumni and other readers who are continuing to co-operate so helpfully in reporting inevitable errors of omission and commission which they note in these listings.

NEW DECORATIONS

1907 Mather, John, *Col.*, U.S.A., Legion of Merit — for developing production methods at the Watertown Arsenal.

1922 Merriam, Kenneth G., *Lt. Col.*, U.S.A., Legion of Merit.

1923 Christmas, John K., *Brig. Gen.*, U.S.A., Distinguished Service Medal — for contribution to, and the supplying of, combat vehicles overseas.

1927 Muchnic, George, *Lt. Col.*, U.S.A., Legion of Merit — for work in connection with the Signal Corps.

1931 Ayres, Gilbert B., *Maj.*, U.S.A., Bronze Star with Oak Leaf Cluster.

1935 Johnston, Philip P., *Lt. Col.*, U.S.A., Bronze Star.

1940 Read, John W., *Capt.*, U.S.A., Bronze Star.
Seedlock, Robert F., *Col.*, U.S.A., Legion of Merit; Chinese Army and Navy Air Medal.

1942 Crowley, Thomas T., *Maj.*, U.S.A., Oak Leaf Cluster to Silver Star; Bronze Star with Oak Leaf Cluster — for meritorious work in the Normandy invasion and on the Continent.
Hayward, Clyde F., *Maj.*, U.S.A., Bronze Star — for meritorious service in connection with Chemical Warfare Service supply.

10–44 Van Greenby, Donald M., *Sgt.*, U.S.A., Silver Star — for gallantry in action in Germany.

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1925 *Pierce, Herbert R., *Lt. Col.*
1941 Baum, Alan W., *Pvt.*
2–46 Dickinson, Hillman, *Cadet.*
10–46 Brown, Dwight, *Pfc.*
Pawel, Thomas E., *Pvt.*
Perkins, Willis D., Jr., *Pvt.*
Poutiatine, Dimitry, *Pvt.*
2–47 Conger, Kenneth L., Jr., *Pvt.*
Friedman, Edward L., *Pvt.*
Hansen, John H., *Pvt.*
Knauer, Arthur F., *Pvt.*
Kriegel, Allan, *Pvt.*
McCarthy, Francis J., *Pvt.*
McReynolds, William U., *Pvt.*
Peloubet, Louis V., *Pvt.*
6–47 Haws, John F., *Pvt.*
10–47 Miller, Richard C., *Pvt.*

U.S.N.

1929 Holt, Wendell R., *Lt. Comdr.*
2–44 Butler, Charles R., *Ens.*
Tillman, Clinton F., *R.T.3c.*
10–44 Scheid, Kenneth G., *Ens.*
6–45 Brown, Walter E., Jr., *R.T.1c.*
Holmes, Arthur S., *Ph.M.2c.*
2–46 Atherton, James R., *Ens.*
Bursnall, William J., *S.2c.*
Carr, Albert F., *S.1c.*
Cavalieri, Albert L., Jr., *S.1c.*
De Val, Eugene J., *S.1c.*
Duncan, William, *Ens.*
Fauvre, Robert F., *S.1c.*
Feingold, Macey, *S.2c.*
Ferencsik, John J., *Ens.*
Fichtenbaum, George L., *Ens.*
Fingerhood, Stanford A., *R.T.3c.*
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Grant, William J., *E.T.M.3c.*
Hague, Wesley M., Jr., *Ens.*
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Hugus, John A., *Ens.*
Hunter, John W., *Ens.*
Karafa, Michael G., *S.2c.*
Kirchner, Karl F., *H.A.1c.*
Knudsen, Per A., *Ens.*
Lawrence, William L., *A.C.*
Loken, Merle K., *Ens.*
Lombard, Robert A., *Ens.*
Marchant, Douglas J., *S.1c.*
Miklau, Ernest P., *F.1c.*
Miller, Jack H., *S.1c.*
Ragni, Victor, *Ens.*
Ross, Donald E., *S.1c.*
Sell, Clifford P., *S.1c.*
Smyth, Robert R., *S.1c.*
Stoltz, Edward, Jr., *S.1c.*
Strawn, Ralph K., *Ens.*
Vallorani, Benito J., *Ens.*
Van Meter, James T., *Ens.*
Watson, Roy D., *Ens.*
Wolfe, Herbert L., *Ens.*
Worrell, George R., *R.T.3c.*
Worssam, Frank H., Jr., *Ens.*
6–46 Cote, Edward A., *S.1c.*
Furman, Robert W., *R.T.3c.*
10–46 Ekstein, Peter R., *A.S.*
Jones, Frank A., Jr., *S.1c.*
Kurylo, William, *S.1c.*
McLain, William K., *A.S.*
Noxon, Elwin I., *S.1c.*
Poland, William B., Jr., *S.1c.*
Rossen, Joel N., *S.1c.*
Rowe, Harrison E., *S.1c.*
Sage, Eddie E., *S.1c.*
Torch, Reuben, *A.S.*
2–47 Anderson, Ralph E., *F.1c.*
Berg, Robert S., *S.1c.*
Bougas, Apollo C., *S.1c.*
Brophy, James D., Jr., *R.T.3c.*
Burr, Malcolm F., *Mid.*
Canfield, Raymond, *M.M.2c.*
Cann, Alfred J., *S.1c.*
Davidson, Richard B., *R.T.3c.*
Deacy, John J., Jr., *S.1c.*
Deranian, Minas, *S.1c.*
Getman, Horace B., *S.1c.*
Gilbert, Henry S., *S.1c.*
Green, Cruts S., *S.1c.*
Hirsch, Robert O., *S.1c.*
Howlett, Eric M., *S.1c.*
Kohl, Richard C., *R.T.3c.*
Lintz, Larry M., *S.1c.*
McConaughy, Robert L., *S.1c.*
Malinowski, Raymond, *A.S.*
Matey, John A., *S.1c.*
Merryman, Philip I., Jr., *S.1c.*
Miselis, Victor W., *S.1c.*
Munroe, William F., *S.1c.*
Neely, Christopher F., *S.1c.*
Oglo, Michael F., *S.1c.*
Poynter, William R., *S.1c.*
Reed, Malcolm E., *S.1c.*
Schotland, Richard M., *Cadet.*
Shrack, John S., Jr., *E.M.1c.*
Smilo, Mitchell, *S.1c.*
Smith, Bruce K., *S.1c.*
Spencer, Richard W., *A.S.*
Steinhardt, Irving, *S.1c.*
Sullivan, Robert J., *S.1c.*
Vail, Donald R., *S.1c.*
Walker, Charles M., *T.5.*
6–47 Whitney, Brayton, *S.1c.*
10–47 Ackerman, Melville W., *A.S.*
Fales, Nathan M., *A.S.*
Ruskin, Bernard J., *S.1c.*
Snyder, George L., *A.S.*
Yarbrough, Donald E., *S.1c.*

THE NETHERLANDS

Navy

10–46 van Stolk, Adriaan P., *Sig.1c.*

CHANGES IN RANK

U.S.A.

1922 Fisk, H. Howland, *Maj.* to *Lt. Col.*
1930 Bowley, Raymond J., *Capt.* to *Maj.*
Dunn, Cecil G., *Lt. Col.* to *Col.*
Gonzalez, Lawrence N., *Capt.* to *Maj.*
Hill, Edwin V., *Maj.* to *Lt. Col.*
Selden, Willard W., *Lt.* to *Capt.*
1933 Longley, John F., *Capt.* to *Maj.*
Newton, Carroll T., *Lt. Col.* to *Col.*
1934 Born, Christian E., *Capt.* to *Maj.*
Moomaw, John D., *Lt.* to *Capt.*
1935 Holley, John S., *Capt.* to *Maj.*
1936 Gilbertson, Victor C., *Lt.* to *Capt.*
1937 Davis, Douglas C., *Maj.* to *Col.*
Pellmounter, Thomas V., *Capt.* to *Maj.*
1938 Freedman, Robert W., *Pvt.* to *Lt.*
1939 Skralskis, Edward P., *Lt.* to *Capt.*
Woolford, Durbin A., *Capt.* to *Maj.*
1940 Chapman, Jack W., *Lt. Col.* to *Col.*
Lee, Edward, *Lt.* to *Capt.*
Leonhard, William E., *Maj.* to *Lt. Col.*
McCabe, Arthur P., *Lt.* to *Capt.*
Magnusson, Frederick S., *Pvt.* to *2nd Lt.*
Russell, Sam C., *Lt. Col.* to *Col.*
Strandrud, Halvor T., *Lt.* to *Capt.*
Wolfe, George M., *Lt.* to *Capt.*
1941 Butt, William T., *Capt.* to *Maj.*
Harper, Raymond D., *Lt.* to *Capt.*
Spengler, Kenneth C., *Maj.* to *Lt. Col.*
1942 Freeman, Leon W., *2nd Lt.* to *Capt.*
Meyer, Frank R., 3d, *Lt.* to *Capt.*
Yamashiro, George, *Corp.* to *Lt.*
1943 Grandgent, Roland, *Lt.* to *Capt.*
Hettich, Bedrich V., *Pvt.* to *Corp.*
2–44 Eagleton, Lee C., *2nd Lt.* to *1st Lt.*
Jevon, Robert W., *A.C.* to *Lt.*
Woody, George D., *Pvt.* to *Lt.*
10–44 Bell, Edwin S., *Pvt.* to *Lt.*
Cruckshank, Paul K., *Pfc.* to *Lt.*
Davis, Peter J., *Pvt.* to *1st Lt.*
Goldson, John D., *Pfc.* to *Lt.*
Hart, William J., *Pvt.* to *Pfc.*
Melville, William R., Jr., *Pfc.* to *Lt.*
Pick, William, *Pvt.* to *T.5.*
Smock, Stanley C., Jr., *Pfc.* to *2nd Lt.*
Van Greenby, Donald M., *Pvt.* to *Sgt.*
6–45 Botway, Donal L., *Pvt.* to *S.Sgt.*
Castor, LaRoy N., Jr., *Pfc.* to *T.5.*
Coombs, William F., Jr., *O.C.* to *2nd Lt.*
Craigie, Hugh A., *Pfc.* to *T.Sgt.*
Reade, Kemp B., *Pvt.* to *Lt.*
Ryan, Frank B., *Pvt.* to *S.Sgt.*
Thompson, John, *A.C.* to *Lt.*

U.S.N.

1910 Spalding, Walter T., *Lt. Comdr.* to *Comdr.*
1911 de Florez, Luis, *Capt.* to *Rear Adm.*
1917 McDaniel, Irving B., *Comdr.* to *Capt.*
1920 Dooley, Henry G., *Lt. Comdr.* to *Comdr.*
1923 Neher, John H., *Lt. Comdr.* to *Comdr.*
1924 Benedict, Howard C., Jr., *Lt.* to *Lt. Comdr.*
1926 Sweeton, John A., *Lt. Comdr.* to *Capt.*
1928 Danis, Anthony L., *Comdr.* to *Capt.*
Titherington, Richard H., Jr., *Lt. (j.g.)* to *Lt. Comdr.*
1930 Hamilton, Charles H., *Lt. (j.g.)* to *Lt. Comdr.*
1931 Davis, Ralph H., *Lt.* to *Lt. Comdr.*
Green, Leo A., *Lt.* to *Lt. Comdr.*
Loomis, Donald S., *Lt. (j.g.)* to *Lt. Comdr.*
Ness, John M., *Lt.* to *Lt. Comdr.*
1932 Anderton, Earl F., *Lt.* to *Lt. Comdr.*
Baker, George, *Lt.* to *Lt. Comdr.*
1933 Sledge, Alexander, *Lt. Comdr.* to *Capt.*
1934 Kopf, William F., *Lt.* to *Lt. Comdr.*
1935 Duff, John, 3d, *Lt.* to *Lt. Comdr.*
1936 Pettebone, Edgar R., 2nd, *Lt.* to *Lt. Comdr.*
Walker, Robert H., *Y.2c.* to *Y.1c.*
1937 Kellerman, Ross R., *Lt. Comdr.* to *Capt.*
1938 Cody, Peer J., *Ens.* to *Lt. (j.g.)*
Eaton, William E., Jr., *Lt.* to *Lt. Comdr.*
Old, Bruce S., *Lt. Comdr.* to *Comdr.*
1939 Baranowski, Walter E., *Lt.* to *Comdr.*
Greenhalgh, John E., *Lt.* to *Lt. Comdr.*
Rex, Daniel F., *Lt. (j.g.)* to *Lt. Comdr.*
1940 Bloom, L. Hurley, *Lt.* to *Lt. Comdr.*
Davis, Harlan H., *Ens.* to *Lt. (j.g.)*
Day, Edward M., *Lt.* to *Comdr.*
Pollak, Edward G., *Ens.* to *Lt.*
Richardson, Spencer M., *A.S.* to *E.T.M.3c.*
Rosse, J. Martin, *Ens.* to *Lt. (j.g.)*
1941 Compton, Wilson M., Jr., *Lt.* to *Lt. Comdr.*
Crawford, Eugene E. D., *Ens.* to *Lt. Comdr.*
Levy, Richard S., *Lt.* to *Lt. Comdr.*
Mengel, Arnold S., *Ens.* to *Lt.*
Meyers, Irving, *Ens.* to *Lt. (j.g.)*
O'Connell, Raymond G., *Lt.* to *Lt. Comdr.*
Phillips, Myron D., *Lt.* to *Lt. Comdr.*
Rodin, Harry, *Lt. (j.g.)* to *Lt. Comdr.*
Weedon, Daniel R., Jr., *Lt.* to *Lt. Comdr.*

RANKS NOT PREVIOUSLY PUBLISHED

U.S.N.

10–44 McCurdy, Harry B., *Ens.*
Woolston, John, *Ens.*

LIBERATED PRISONERS

U.S.N.

1940 Pollak, Edward G., *Lt.* — Japan.

CASUALTIES

1925 *Pierce, Herbert R., *Lt. Col.*, U.S.A. — as a result of illness contracted in China.

1930 ★Peoples, Ulysses J., Jr., *Lt. Col.*, U.S.A. — while on a prison ship.

1941 *Branham, Hugh M., *Lt.*, U.S.A. — plane crash in Guam.

1942 ★Traupe, William F., *Capt.*, U.S.A. — Germany.

10–44 ★Herb, John W., *Lt.*, U.S.A. — Germany.

★ Killed in Action † Missing in Action ‡ Prisoner of War * Died or Killed in Service ** Wounded

Class Analysis

M.I.T. MEN AT WAR

Class	*Army*	*Navy*	*U.S.C.G.*	*U.S.M.C.*	*Allied Nations*	*Total*
1895	1		1			2
1896	2		1			3
1897	1		1			2
1898	2	1				3
1900	1					1
1901	2	2				4
1902	5	1	1			7
1903	2					2
1904	1	1				2
1905	5	6				11
1906	6	3				9
1907	8	5				13
1908	4	6				10
1909	9	4	1		1	15
1910	19	7				26
1911	19	2	1			22
1912	12	6				18
1913	15	5			3	23
1914	14	7		1		22
1915	13	7			1	21
1916	26	10	1		1	38
1917	37	32	2		1	72
1918	29	13				42
1919	22	12				34
1920	32	33		2		67
1921	106	41			1	148
1922	101	50	1	1	1	154
1923	91	55	2	1	3	152
1924	73	50		1	1	125
1925	76	45	1	1	1	124
1926	72	48	1	1	1	123
1927	77	33		1	1	112
1928	88	65			4	157
1929	79	46	3		2	130
1930	114	64		1	2	181
1931	122	65	1	2	2	192
1932	144	76	3	1	3	227
1933	155	84	2	7	3	251
1934	175	77	2	4	3	261
1935	171	58	3	3	2	237
1936	152	79	4	5	5	245
1937	168	63		2	2	235
1938	196	86		4	1	287
1939	222	97	2	4	6	331
1940	275	150	5	6	9	445
1941	310	200	5	8	2	525
1942	434	228	3	9	13	687
1943	229	216	4	13	6	468
2–44	346	177	4	9	5	541
10–44	415	238	4	19	14	690
6–45	326	423	7	26	5	787
2–46	173	398		7		578
6–46		33				33
10–46	16	71	1	2	1	91
2–47	43	149	2	3	1	198
6–47	1	5				6
10–47	4	14				18
TOTAL	5,241	3,647	69	144	107	9,208

Normalcy

REMEMBER THAT WORD? It's been bandied about rather loosely for some time. "Returning to normalcy." Mr. Webster says it means returning to the state or fact of the usual condition. That's straightforward enough. All you have to do now is define the usual condition of business, world affairs, or, to make it simpler, your own personal affairs. Chances are you'll come up with an answer not far removed from the famous Navy definition.

Returning to normalcy at the Institute, however, does have some significance. A cartload of rubber stamps with the warnings "Secret," "Top Secret," and "Confidential" went onto the dump recently. Boys who left their classes not so long ago have returned, doffed their captains' and majors' uniforms, and are sitting in the same seats again. Not all of them will be back. Faculty members who dropped out of sight overnight have reappeared just as suddenly. A few more gray hairs, a bit travel-worn perhaps, but answering the call of the class bells just as they used to do. There have been changes, of course, many of them, but few that are apparent on the surface. When you come back on Alumni Day, the Institute will seem to be just about the same as ever. It will certainly look as though it had returned to normalcy.

There is one change, however, one of vital importance to the Institute, which you will not see on a stroll through the corridors. It is contained in the Treasurer's Report. Not hidden, exactly, but not one of those things that leaps out at you. In 1940, the Institute's general investments were 33⅓ million dollars. By January, 1946, that figure had grown to 41½ millions, an increase of over eight million dollars. That looks like a rather tidy sum, as indeed it is. But during that same period, the yield from these funds at market decreased from 4.52 per cent to 2.72 per cent. Income has dropped off appreciably.

These fluctuations are, of course, inevitable. However, they mean that M.I.T. does not have a stable income from its invested funds, that a growing endowment does not necessarily mean increased funds on hand. There's nothing new or unexpected in this fact, but it is a consideration which many of us are prone to forget. That is one reason why the Alumni Fund is important. It is a stabilized source of income, one on which the Institute can depend. It is a living endowment, and one whose magnitude cannot be overlooked. This year our gift to M.I.T. will be equivalent, even at the present rate of return, to the income from an increased endowment of almost 3⅓ million dollars.

ALUMNI AND OFFICERS IN THE NEWS

Awards and Rewards

¶ For WILLIAM D. COOLIDGE '96, recipient of the jewel of the Order of Merit of the Chilean Government.

¶ For CHARLES-EDWARD A. WINSLOW '98, for the second time presented with the Elizabeth Severence Prentiss Award in health education at a civic luncheon celebrating the fifth anniversary of the Cleveland Health Museum.

¶ For ANDREY A. POTTER '03, honored by the Eastern New England Purdue Club, which tendered him a dinner at the Engineers Club in Boston on December 1. Dean Potter, HAROLD G. BOWEN, JR., '37, Rear Admiral, U.S.N., and DUGALD C. JACKSON, emeritus, received diplomas as honorary members of the American Society of Mechanical Engineers at the annual meeting.

¶ For L. STANDISH HALL '14, winner of the annual Hilgard prize, for the best paper on flowing water.

¶ For VANNEVAR BUSH '16, winner of the Marcellus Hartley (Public Welfare) Medal.

¶ For FRED E. ZURWELLE '20, given a civilian service award for outstanding work with the United States Engineers during the war.

¶ For ROBERT P. RUSSELL '22, awarded the 1946 Gold Medal of the American Institute of Chemists in recognition of his "genius as a chemist, chemical engineer, and administrator."

¶ For JOSEPH C. GORA '33, winner of a $1,000 award in the Chicago *Tribune's* Chicagoland Prize Homes competition.

Higher and Hire

¶ ROBERT T. HASLAM '11, recently promoted to be vice-president and director of the Standard Oil Company of New Jersey.

¶ WINTHROP E. CALDWELL '13, elected president of the Casket Manufacturers' Association of America.

¶ THOMAS H. GREEN '14, a brigadier general, on December 1 confirmed as judge advocate general of the United States Army.

¶ ALDEN H. WAITT '14, a major general, made new chief of the Chemical Warfare Service on November 29.

¶ HAROLD W. STIEGLER '20, a lieutenant colonel, appointed as director of research for the American Association of Textile Chemists and Colorists.

¶ GEORGE R. PROUT '22, elected a vice-president of the General Electric Company.

¶ WILLIAM WALWORTH '26, chosen vice-president and chief engineer of the Mack Manufacturing Corporation.

¶ GEORGE B. DARLING '27, appointed executive secretary of the National Academy of Sciences and of the National Research Council.

¶ FREDERICK A. RITCHIE '31, elected a vice-president of the National Shawmut Bank of Boston.

¶ DAVID B. SMITH '33, named vice-president in charge of engineering for the Philco Corporation.

Pages by Sages

¶ WILLIAM D. COOLIDGE '96, "Some Experiences with the X Ray," and with E. E. Charlton, "X-Ray History and Development," *Electrical Engineering*, December.

¶ ALEXIS R. WIREN '19 and Carl Heyel, *Practical Management Research*, a book, published by McGraw-Hill.

¶ JOHN H. TEETER '22, "Federal Aid to Research," *Journal of Higher Education*, December.

¶ JOHN E. BURCHARD '23, "A Signpost in Virginia," *Journal of the American Institute of Architects*, January.

¶ PIERRE M. HONNELL '39, Lieutenant Colonel, S.C., "The Prony Brake," *Journal of Engineering Education*, November; "Note on the Measurement of Transformer Turns-Ratio," *Proceedings of the Institute of Radio Engineers*, November; and "New Frequency Unit," a letter to the editor, *Electrical Engineering*, November.

DEATHS

* *Mentioned in class notes.*

¶ HARRY A. BROWN '77, November 25.*

¶ ALBERT C. BRACKETT '82, January 7.

¶ HARVEY M. MANSFIELD '83, December 20.

¶ ELLIOTT T. STURGIS '84, October 21.

¶ ROBERT E. ANDERSON '87, August 8.*

¶ WINTHROP COLE '87, December 12.*

¶ WALTER ATHERTON '89, November 23.*

¶ JACOB W. MANNING '89, October 29.*

¶ WILLIAM E. MOTT '89, October 5.*

¶ FRANK A. SMYTHE '89, November 8.*

¶ FRANK C. BALDWIN '90, November 25.

¶ CHARLES F. FITTS '90, October 17.

¶ JAMES J. WELCH '91, October 27.*

¶ GEORGE O. ROLLINS '93, date unknown.

¶ NELSON W. DALTON '94, October 17.

¶ JOHN F. BROOKS '96, November 6.*

¶ HARRY G. FISK '96, November 30.*

¶ EDGAR B. BAUMANN '97, March 15.

¶ WILLIAM A. KENT '97, March 27.

¶ WILLIAM S. B. DANA '98, July 23.

¶ WILLIAM B. FLYNN '99, December 30, 1944.*

¶ G. MANNING GALE '99, October 11.

¶ WILLIAM L. MORRIS '99, December 8.

¶ HAROLD S. CONANT '00, January, 1942.*

¶ FREDERICK C. LINDSLEY '00, April.*

¶ MATTHEW M. CUSHING '01, October 24.*

¶ HORACE E. HILDRETH '01, November 7.*

¶ STUART B. MILLER '01, December 3.*

¶ WILLIAM A. EVANS '04, November 23.

¶ FREDERICK W. HORTON '04, November 24.

¶ JOHN H. LOCKE '08, November 12.

¶ GEORGE P. SULLIVAN '11, November 25.*

¶ GEORGE R. BARTLETT '13, December 5.

¶ PORTER H. ADAMS '14, December 5.*

¶ HAROLD WARREN '14, January 3, 1945.

¶ ALFRED F. NYE '15, May 14.

¶ DONALD H. WHITE '15, September 3, 1944.

¶ ERNEST T. HICKMAN '18, January 14, 1945.

¶ DONALD B. PARKINSON '18, November 17.

¶ MYLES F. CONNORS '19, December 31.

¶ HOBART O. DAVIDSON '20, September 22.

¶ JOHN T. TUNIS, JR., '20, September 17.*

¶ EDMUND I. HOWARD '21, August 13.*

¶ DAVID A. NEWCOMER '21, August 25, 1944.*

¶ CARL W. STARCK '21, February 28, 1945.*

¶ WALTER J. GUNDELFINGER '24, May 20.

¶ HERBERT R. PIERCE '25, October 30.

¶ DEXTER K. COOLIDGE '27, May 30.*

¶ LYMAN B. JOHNSON '27, August 25.*

¶ JOSEPH A. PARKS, JR., '28, December 15.

¶ ULYSSES J. L. PEOPLES, JR., '30, December 15, 1944.*

¶ JOHN G. F. PRESCOTT '36, October 29.

¶ HUGH M. BRANHAM '41, November 7.*

¶ MILTON C. REEVES '41, November 23, 1943.*

NEWS FROM THE CLUBS AND CLASSES

CLUB NOTES

Technology Club of Chicago

The Club held a luncheon meeting at the University Club on November 29. The past President, Sherry O'Brien '17, acted as toastmaster in place of Ed Farrand '21, President, who was confined to his home by influenza. The guest speaker was Nathan Shefferman, President of Labor Relations Associates and the labor relation council of Sears, Roebuck and Company. Sherry O'Brien pointed out that the predictions made when Mr. Shefferman had addressed the Club seven years before about the labor movement had come true 100 per cent. Speaking of present-day labor problems, Mr. Shefferman discussed the probable outcome of some of the most serious disputes between labor and management. He believes the whole problem to be one of dealing with human beings; the solution, a study of human relationships. He outlined numerous examples of labor difficulty, with the source of trouble and their ultimate resolutions or failure, in the light of the consideration given to human relationships, the theme of his talk. Justice could not be done so important a subject in the time allotted, but even his brief outline drew a barrage of questions, both questions and answers proving most enlightening.

Among the members present were the following: T. M. Lothrop '95, P. W. Moore '01, L. L. Hunter '03, E. G. Allen '05, I. W. Kahn '06, R. B. Anthony '08, T. B. Black '09, John Munro Longyear '10, John Law Wilds '11, F. W. Bucknam '16, E. D. Hale '16, E. P. Brooks '17, Sherry O'Brien '17, Pierre Blouke '19, L. E. Boyden '20, G. H. Burt '20, L. B. Hitchcock '20, F. M. Post '21, V. V. Cocks '23, Philip Coleman '23, S. C. Massari '24, James Elliott '25, F. D. O'Neil '25, J. S. Offutt '26, J. H. Wills '26, J. G. Praetz, Jr., '28, E. F. Abbott, Jr., '31, E. E. Langeland '31, T. B. Spruill '31, D. W. Fetters '32, L. E. Jones '32, W. A. Meyer '32, R. G. Seyl '33, G. A. Danforth '34, E. D. Szantay '35, T. P. Nelligan '36, M. L. Rockwell '37, F. J. Port, Jr., '39, W. R. Schuler '40, and W. G. Baird, Jr., '42. — ELMER D. SZANTAY '35, *Secretary*, Sandee Manufacturing Company, 3945 North Western Avenue, Chicago 18, Ill.

Indiana Association of the M.I.T.

For our second dinner meeting of the season, we had an exclusive public preview. R. G. du Bois '34 of the Allison division of the General Motors Corporation gave a talk on the Army Air Forces' new bomber, the Douglas XB-42, nicknamed the Mixmaster. By pure coincidence the record-breaking cross-country flight of the airplane took place a few days before our meeting. Mr. du Bois, who was the power plant project engineer for Allison to Douglas, gave a very interesting description of the problems overcome during the two-year development of the bomber.

The following were the Alumni present: W. M. Taylor '86, J. Lloyd Wayne, 3d, '96, H. S. Morse '03, John B. Welch '13, John H. Babbitt '17, Roy C. Mitchell '21, Harry Karcher '25, T. G. Harvey '28, G. W. Klumpp '30, R. G. du Bois '34, C. L. Bouchard '36, and Marshall D. McCuen '40. — MARSHALL D. MCCUEN '40, *Secretary*, 6037 Norwaldo Avenue, Indianapolis 5, Ind.

Technology Club of the Philippines

Continued interest in the Club's activities was shown by the large attendance at the meeting on December 12 held at the City Planning Quonset Hut, on the grounds of Malacañan Palace. Many of the older members of the Manila Club were in attendance, including two past presidents, Aubrey P. Ames '19, and Bernardo P. Abrera '32. The first part of the meeting was devoted to the election of club officers. The following were chosen: Marvin H. Dixon '30, President; Bernardo P. Abrera '32, Vice-president; and Stanley M. Porosky '43, Secretary-Treasurer.

The Club was fortunate to have for its speaker Antonio C. Kayanan '42, who is city planning consultant in the office of the President of the Philippine Commonwealth. He took for his subject "Planning of the Cities in the Philippines." Using Manila as an example, he described the type of planning that is being done for rehabilitation of the damaged areas in the Philippines. Illustrating his talk with a number of exceptionally fine charts and architectural drawings, Mr. Kayanan pointed out the importance of the plan of radial and circumferential routes to be laid out in the form of a spider web. According to him, such placement and spacing of the major thoroughfares will create land areas suitable for the development of groups of self-contained neighborhoods, each complete with its own schools, playgrounds, local shops, churches, clinics, and other living facilities. Mr. Kayanan emphasized that the planning was being done by the people themselves rather than by any one particular group. At the conclusion of this exceptionally interesting talk, he distributed brochures and held a short question-and-answer period.

Sandwiches and cold beer, provided through the efforts of Max I. Planes '41 and Frank Smith '43, served as a pleasant interlude in the proceedings. At the close of the meeting, Colonel Dixon, the Club's new President, suggested that advantage be taken of the opportunity to make plant visits and to consider other points that may be of interest to engineers. The next gathering, however, planned for the 6th of January, will consist of a boat ride up the Pasig River. Francisco Santana '32 has been kind enough to offer his home for a picnic party at the end of the trip.

The following Technology Alumni attended this meeting: Bernardo P. Abrera '32, Aubrey P. Ames '19, C. Carlos Arguelles '41, Lawson L. Bowers '42, William M. Boyle '44, William J. Bright '43, Randall S. Caswell '44, Robert I. Clarke '44, Edward M. Coan '45, Cesar H. Concio '40, Marvin H. Dixon '30, Lawrence C. Hamlin '29, G. Scott Hammonds '34, James D. Ingham '43, Burton H. Kahn '45, Antonio C. Kayanan '42, Kenneth A. Lambert, Jr., '45, Walter W. Lappin '31, Kenneth C. Lish '40, Franklin D. Mabbett '43, Manuel T. Mañosa '21, David B. Mitchell '42, Frederick K. Mulhaupt '43, Lawrence E. Nelson '44, Frederick F. Noonan '40, George Oetinger, Jr., '25, Jesus C. Perlas '40, Max I. Planes '41, Tomas de los Reyes '39, Gines F. Rivera '38, James F. Robertson, Jr., '45, Albert C. Saer '43, Francisco D. Santana '32, Paul B. Sawyer '45, Kenneth G. Scheid '45, William D. Sewall '45, Frank S. Smith '43, Robert B. Smith '44, Newton A. Teixeira '44, John P. Walsted '29. — STANLEY M. POROSKY '43, *Secretary*, Headquarters, Army Forces Western Pacific, Office of the Chief Signal Officer, Signal Supply Division, A.P.O. 707, care of Postmaster, San Francisco, Calif.

Technology Club of New York

Elsewhere in this issue appear the details of our banquet at the Biltmore Hotel on December 5. Some five hundred Technology Alumni and their wives turned out to honor Dr. and Mrs. Compton. We felt very fortunate to have received such excellent support from the Alumni around Greater New York but take little credit upon ourselves. It was undoubtedly a tribute to our justly popular President and his charming wife. I might also add that our gratitude is due Bill Mueser '22, chairman of the banquet committee, and George Dandrow '22 for their last-minute efforts in rounding up one of the largest and highest quality groups that any alumni club has ever been privileged to entertain. As for the speakers, General Groves '17, Bradley Dewey '09, and A. Warren Norton '21 did excellent jobs of outlining the contribution made by the Institute to the war effort and also gave due credit to individual Alumni for their wartime exertions. Doctor Compton told some very interesting anecdotes of his trip to Manila and Tokyo and of his contacts with General MacArthur and his Command. Space does not permit our listing the many notable guests in attendance at the banquet, and to avoid repetition we are not listing the guests of honor again.

We are happy to announce the election, during the last month, of nine new members to the Club, as follows: Ray H. Bartlett '19, Williams Rosenwald '24, Roland T. Seabury '25, William Kalker '26, Melville J. Blackwood '30, George Henning, Jr., '33, John L. Joseph '40, David B. Nichinson '42, and Thomas S. Jackson '45. There are a great many more on file for election at our next meeting, but they will be reported at a later date. Also, we were fortunate to have as out-of-town guests during the current month the following:

M. R. Scharff '09, W. H. Martin '11, H. E. Wellcome '17, Eric Etherington '20, Lachlan Mackenzie '22, Griffin Crafts '24, W. H. Callahan '26, M. L. Grossman '26, J. R. Killian, Jr., '26, R. D. Earle '28, Ralph T. Jope '28, Truman S. Gray '29, N. J. Anton '31, S. M. Goble, Jr., '31, W. M. Murray '33, I. H. Summer '33, E. V. Piel '38, and W. L. Walsh, staff.

Some interesting correspondence has been received by your Secretary. Alfred G. Baum '45 writes us from Schofield Barracks, Hawaii, on the reverse side of a military map of the island of Oahu. He is a member of an engineer map depot detachment, and they have been plenty busy. Maurice Scharff, a colonel in the Corps of Engineers, and W. R. Franklin '26, a lieutenant commander in the Navy, dropped in on us.

The Class of 1915 held a class dinner on November 30, for which some 35 or 40 members turned out. No doubt more details will be forthcoming in the class notes from Azel Mack, Secretary. Any news items that you have will be very much appreciated by your Secretary, and again we should like to encourage more of the classes to hold occasional luncheons or dinners at the clubhouse. — WILLIAM W. QUARLES '24, *Secretary*, McGraw-Hill Publishing Company, 330 West 42d Street, New York 18, N.Y.

Technology Club of Philadelphia

On December 11 a new president of Drexel Institute of Technology in Philadelphia was inducted. At the request of Dr. Compton, our genial prexy, Andy Anderson '15, represented the Institute. The speakers at the convocation revealed such diversified opinions of the future of specialized technological education that repetition is warranted. You will note the leaning toward compulsory military training and the degree of exposure recommended. Declaring that compulsory military training is inevitable, James Creese, who spoke at his formal induction as Drexel's sixth president at the school's 54th Founder's Day exercises in the auditorium at 32d and Chestnut Streets, advocated an initial training period of four months instead of a year and urged that such training be integrated with other schooling. Dr. Creese suggested alternate terms of service in camp and in classrooms or industrial shops. He urged a broadening of vocational and professional studies by colleges and universities, not merely to meet immediate requirements of returning veterans but "to close the gap between the everyday affairs of life and the concerns of scholarship. If there is to be universal military training — and I believe there must be — then let it be made a consistently integrated part of our total training," Dr. Creese continued.

The Founder's Day address was made by Harold C. Urey, professor of chemistry at the University of Chicago, Nobel prize winner, and one of the group of scientists responsible for the development of the atomic bomb. Dr. Urey pointed out that the discovery of the atomic bomb represents a turning point in history. "It is no longer possible," he said, "for us to go back to the time before atomic energy was discovered. The atomic bomb is with us from now on, and we must meet all the problems it brought with it."

Another speaker, Harold W. Dodds, President of Princeton University, declared that excessive attention to technological skills in education "turns a man into a mere specialist, a lopsided human being." He told the more than 1,000 persons assembled in the Bellevue-Stratford for the inaugural dinner of Dr. Creese that "skill in technology alone will not save us" in the atomic age. "We must apply our knowledge of human values and social institutions to the world of today. We must apply the knowledge which the social sciences, art, literature, ethics, and philosophy supply to a world where traditional moral values have collapsed, as . . . in Europe."

Harvey N. Davis, President of Stevens Institute of Technology at Hoboken, N.J., said that both the technical and the humanistic types of education have their place. "Technical education," said Dr. Davis, "seems to have clearly defined objectives, whereas cultural education apparently has to formulate its aims in more general terms. I notice that the soul searching that is going on in the college world of today is almost wholly confined to the arts colleges. They seem to be the ones on the defensive in this postwar age."

We are exceedingly glad to report the return to Philadelphia of Hal L. Bemis '35, a lieutenant colonel. A perusal of the December issue of The Review will disclose his new decorations and the Bronze Star awarded to Henry S. Dimmick '22, also a lieutenant colonel, to whom we extend our thanks and appreciation for his acknowledged contribution to the welfare of mankind. Your Secretary telephoned his congratulations to Stew and was promptly rewarded with a denial. Those who know him for the modest lamb he is will be inclined to accept his contradiction with the proverbial "grain of salt." Without merit one does not receive from the President of the United States a citation as the commander of one of the two outstanding antiaircraft batteries. Further, our good friend Dimmick should know better than to doubt the veracity of The Review. It may take unexplained license with the wording of the reports of the club secretaries and publish them so many months after they have been written that they are ancient history, but it is impossible to believe that it would itself publish any inaccuracies.

Commendable progress is being made by capable Ed Healy '23 and his placement planning and guidance committee. Those who have seen the results of his efforts and his interest do not hesitate to recommend his helping hand to any Alumnus contemplating the Philadelphia area for his future business activities. Those wishing pertinent information about the Club or its members may call JEFferson 0642. — EDWARDES S. PETZE '28, *Secretary*, Scott Paper Company, Chester, Pa. *Assistant Secretaries:* HAROLD BOERICKE, Jr., '44, 5932 Overbrook Avenue, Philadelphia, Pa.; ROBERT M. HARBECK '28, Fidelity Machine Company, 3908 Frankford Avenue, Philadelphia 24, Pa.

Washington Society of the M.I.T.

The Society met as usual in the Young Women's Christian Association on the second Thursday of December, the 13th. All Tech Alumni who are in Washington on second Thursdays are cordially invited to drop in on us at 6:00 P.M. We always eat, and now that the war is over, we are eating better and better. So do join us whenever you can.

Since Harry Fisk '22 was ill, someone else had to be drafted as tenor for the carols presented by the quartet. Your reporter filled in as best he could. The other members of the quartet are Nick Stathis '29, Charlie Maskell '30, and Larry Conant '21. Our star pianist, Joe Gaffney '28, of course accompanied the singers, and delighted the whole group with an endless variety of music. You name it and Joe plays it. After dinner our President, Bill MacMahon '22, presented the speaker. Bill had a timely program for us — on the night we were hearing a firsthand report on our international relations with the Russians, Secretary Byrnes was in Moscow, again trying for a mutual agreement.

The speaker was Charles Prince, who has made Russia a subject of lifelong study. He is the expert on Russia for the United States Chamber of Commerce and is well known through his many appearances in print. Dr. Prince speaks with authority and displays an amazing intimacy with the intricate details of Russian history, statecraft, and opinion. He commanded the attention of all present and was generous in answering the spontaneous burst of questions following the formal address. The basic thesis which Dr. Prince expounded was that the Soviet point of view has been inadvertently misrepresented in the United States by friend and foe alike. Hence the miasma of mutual suspicion has become all the more confounded. According to Dr. Prince, there is no fundamental conflict of interest between the United States and the Soviet Republics which cannot be integrated. So far Congress has been guided to agree only on "fringe" issues, while American policy on the basic items has been established and carried out by a small group of individuals in the State Department.

"The policy setters in Russia," said the speaker, "are not the statesmen who attend the world conferences. When the delegates make agreements differing from their views, the agreements have to be changed. This parallels our own case, wherein agreements made by American delegates must satisfy our State Department group before they are put into effect."

As to the recent whereabouts of Joseph Stalin, Dr. Prince voiced the opinion that the Marshal has been performing his duties by personally directing the revolution in Iran and the far-reaching preparations of Soviet political, economic, and military onslaught against Turkey. These predatory activities against Turkey have been in the offing during the past two years.

"The Soviet," he observed, "has found the United States following British leadership in matters of world policy for years. They feel that we shall probably continue to do so. Since there are spheres of difference between Britain and the Soviet, we are at times caught in the Russian suspicion of the British." Likewise, he thinks, a policy of appeasement is fraught with danger, and the Soviets resent it.

The answer to the problem was presented as follows: The United States must continue to minimize the areas of disagree-

ment between us and enhance the areas of agreement. This country must try for a better understanding of things Russian by sending its citizens to Russia to live and study. We can ill afford to perpetuate the rancors of the past by preventing our scholars from visiting the Soviet Republics. The present hysteria about the atomic bomb as a weapon to bring Russia into line should cease. America's use of the atomic bomb injured Soviet pride and increased their feeling of insecurity. We should regard the U.S.S.R. as a progressive country which will have to be lived with permanently. Since the Soviet is only 28 years old, we must not expect it to have learned all we have in 150 years of national life. We urgently need, however, to become aware of the impact of the interlocking Soviet activities in all five fields: political, economic, social, geographic, and psychological. We must keep abreast of Russian policy by careful study of current speeches and writing. This is the only way to keep up to date with a policy subject to change. There appears nothing in the nature of the dichotomy of the Soviet expansionism to threaten the strategic interests or security of the United States; but Soviet activities in Iran and the imminent attacks on Turkey do threaten the security of parts of the British Empire.

The following Alumni attended: 1889: G. W. Stone; 1890: J. G. Crane; 1892: B. P. du Bois; 1893: G. W. Stose, P. H. Thomas; 1897: P. L. Dougherty; 1900: C. H. Stratton; 1903: Hewitt Crosby; 1904: A. M. Holcombe, F. W. Milliken, G. C. Riddell, G. N. Wheat; 1905: J. A. Furer, O. C. Merrill, E. T. Steel; 1906: A. L. Sherman; 1909: E. D. Merrill, B. A. Robinson; 1911: D. P. Allen; 1912: A. M. Pedersen; 1915: A. D. Beidelman; 1916: F. P. Upton, W. E. Wentworth; 1917: W. C. Mehaffey; 1919: L. J. Grayson, A. C. Kenison, M. P. Smith; 1920: John Nolen, Jr.; 1921: L. W. Conant; 1922: W. K. MacMahon, J. R. Morton, Jr.; 1924: W. V. Cash, W. D. Rowe, R. P. Schreiber, G. M. Tapley; 1925: H. B. Swett; 1926: T. L. Soo-Hoo; 1927: E. G. Cowen; 1928: J. W. Gaffney; 1929: N. P. Stathis; 1930: G. L. Arnold, A. F. Bird, J. R. Bloom, O. G. Green, C. W. Maskell, N. C. Nelson; 1931: S. S. Prentiss; 1932: F. M. Moss; 1933: S. F. Allison, J. F. Longley; 1934: J. F. Burke, Elizabeth Scheu Close; 1936: W. B. Sharp, Jr.; 1937: G. B. Hunter, Jr.; 1938: R. C. Coile; 1941: T. F. Walkowicz; 1942: Z. W. Wilchinsky. — FRANK W. MILLIKEN '04, *Secretary*, 613 Greenwich Street, Falls Church, Va. ALBERT F. BIRD, *Review Secretary*, 5070 Temple Hills Road, Southeast, Washington 20, D.C.

CLASS NOTES

1877

Harry A. Brown, a lifelong resident of Lowell, Mass., died at his home, 40 Talbot Street, on November 25, at the age of 89 years. He was the son of Samuel and Sarah (Butler) Brown. For a limited time he was a member of our Class at Technology but later became interested in legal procedure. He "read law" in the office of Judge Abbott in Westford. After being admitted to the bar, he established his own office in Lowell and practiced there for more than half a century, retiring when past 80. He was a charter member and one-time president of the Yorick Club. He was also a charter member of the Vesper Country Club. He belonged to the Lowell Bar Association and to All Saints Church. Brown was a quiet man, devoted to his home and family. He was a great reader of Shakespeare and of translations of Greek plays. His hobby was wild life, particularly birds, and this pleasure endured to the end. He married Mary E. Sawyer, and October marked the 58th anniversary of their wedding. He is survived by his wife, by a daughter, Mrs. Robert I. Jones of Chelmsford, Mass., and by two grandchildren, Barbara Brown and Robert I. Jones, Jr.

By Brown's passing, the living members of our Class are reduced to only six. — GEORGE W. KITTREDGE, *Secretary*, 592 North Broadway, Yonkers 3, N.Y.

1887

Your Secretary regrets to announce that the Class suffered the loss by death recently of two of its members, Robert Emery Anderson of Newton Center, who passed away on August 8, and Winthrop Cole, who died very suddenly on December 2 at his Massachusetts Avenue apartment, where he had made his home for the past 20 years. In the passing of the latter the Class has suffered an irreparable loss. For a number of years Vice-president, and for the past five years Treasurer, Winthrop has faithfully and loyally carried the burdens of planning all class activities and functions; in addition, he has served as the representative of the Class on the Alumni Council. Because of the shortness of the time available, your Secretary is able to make but brief announcement of his loss but will be able in the next number of The Review to pay a more extended and fitting tribute to the memory of the man who for the past score of years has worked so faithfully and efficiently in the interests of the Class he so dearly loved. — NATHANIEL T. VERY, *Secretary*, 15 Dearborn Street, Salem, Mass.

1888

Our one and only honorary member, Katharine Keough, a junior grade lieutenant in the Naval Reserve, reports as follows: "I left Sampson in May and reported to the ammunition handling school at the Naval Ammunition Depot at Hingham, Mass. I was assistant personnel officer in charge of the officer students who were being trained there. They sent me to the receiving station at the Fargo Building in Boston for duty. I am in the office where they handle the ships' companies and their records. I am eligible for discharge on the first of December. I'm not sure whether I'll get out then or stay for a while. I should love to go to Florida on a trip after I get out but it doesn't look as though I could do very well on accommodations. Of course if I stay in for a while I shan't be interested in a trip South. The problem of getting accommodations anywhere these days is great. My brother Jack was still in Korea the last we heard. He is waiting for transportation home. I hope that you had a nice summer in Maine. It is so delightful there with the cool breezes off the bay. It certainly is wonderful that all the fighting is over. I hope that the people will take the responsibilities of providing a just and lasting peace."

Edward Gould has moved from Fort Worth, Texas, to 4322 East Second Street, Long Beach, Calif. Charles Merrell is enjoying his winter bowling on the green at his permanent home on the Gulf of Mexico at Dunedin, Fla. John Runkle is providing accommodations for returned naval personnel in his luxurious home at 1 Francis Avenue, Cambridge, Mass.

Your Secretary is glad to report the return, in time for Christmas, of his son-in-law, James R. Hughes, Jr., a lieutenant in the Naval Reserve, direct from Korea, after nearly a year in southern and western Pacific waters. — BERTRAND R. T. COLLINS, *Secretary*, 76 Murray Place, Princeton, N.J. SANFORD E. THOMPSON, *Assistant Secretary*, The Thompson and Lichtner Company, Inc., Park Square Building, Boston 15, Mass.

1889

The Secretary has to report a number of deaths this month. Billy Mott passed away on October 5. The New York *Herald Tribune* published the following account of his life and work: "William Elton Mott, seventy-seven, retired director of the College of Engineering of the Carnegie Institute of Technology, died here [Trenton, N.J.] of a heart ailment. He was stricken in the Pennsylvania Railroad Station while descending a stairway to his train. Mr. Mott had been visiting his daughter, Mrs. George R. Martin, of Pelham Manor, N.Y., for three weeks and was en route to his home in Burlington, N.J., where he lives at 315 Wood Street. He resigned as head of the engineering college in 1932, after serving for thirteen years in that post. From 1917 to 1919, he was dean of the School of Applied Science at Carnegie Institute. A native of Burlington, he attended the University of Pennsylvania and received a Bachelor of Science degree in civil engineering in 1889 from . . . Technology. Immediately after graduation he became an assistant instructor in civil engineering at M.I.T. In 1901 he was in private civil engineering work. He joined the faculty of Cornell University in 1892 as an instructor and from 1901 to 1905 was an assistant professor in civil engineering. . . . He rejoined the faculty of M.I.T. in 1905 as an associate professor of hydraulic engineering and remained four years. He left to become a professor of civil engineering at C.I.T., where he spent the next twenty-three years. Mr. Mott was a director of the Burlington Savings Institute, a director of the Burlington Library and a director of the St. Mary's School for Girls. Surviving, besides Mrs. Martin, is another daughter, Mrs. Raymond J. Roark, of Madison, Wis."

The same paper, in its issue of November 10, contained the following regarding the passing of Frank Smythe: "Frank A. Smythe, seventy-seven, president of the Thew Shovel Company of Lorain since its establishment in 1898, died [on November 8] at Elyria [Ohio] Memorial Hospital. Born in Worcester, Mass., Mr. Smythe was a graduate of . . . Technology. He was chairman of the advisory commission of the Cleveland Federal Reserve Bank from 1934 to 1941 and in 1943 and 1944 was a member of the Cleveland War Labor Board.

He was president emeritus of the Masonic Temple Association of Cleveland."

Under the caption "Noted Boston Architect Dies," the Boston *Herald* carried the following notice of the death of Walter Atherton: "Services for Walter Atherton, 130 Commonwealth Avenue, Boston architect and trustee and descendant of one of the nation's earliest settlers, will be held . . . at the First Church of Boston. He died [on November 23] at the age of 82. Associated at various times with the architectural offices of Fehmer & Page, Herbert D. Hale, John W. Ames and Edwin S. Dodge, Mr. Atherton designed and constructed many schools and other public buildings, Y.M.C.A. buildings and private homes in New England, New York and New Jersey. He was the first to adapt and install mechanical sterilization and filtration in swimming pools. In addition to his professional activities, he was trustee of many estates, and although he retired as an active architect in 1935, he continued in his trusteeships until his death. In 1889, after participation in a United States geological survey, he joined a group of scientists for one of the first explorations of the Grand Canyon. Born in Stoughton, March 18, 1863, he studied at Andover, at Harvard University, in the class of 1885; and specialized in architecture at . . . Technology. He later studied in Paris, in 1893–95. During the Spanish-American war he was a member of the First Corps of Cadets, Massachusetts Volunteer Militia, and in the World War he was chairman of the architects' committee for raising war funds. He also was secretary of the committee that organized, recruited and equipped the First Motor Squadron of the 101st Engineers. In 1918 he taught military mapping to the training corps at Harvard. He was a member of the American Institute of Architects, Boston Society of Architects, New York Society of Beaux Arts Architects, Society of Colonial Wars, Society of the Sons of the Revolution, the Governor and Company of the Massachusetts Bay in New England, Military Historical Society of Massachusetts, Bostonian Society, New England Historic Genealogical Society and the Union, St. Botolph and Harvard Clubs of Boston and the Harvard Club of New York. He leaves his wife, Mrs. Grace H. Atherton, three step-children, Thayer Thorndike of Los Angeles, Mrs. Donald S. Mackay of Berkeley, Cal., and Mrs. Thorndike Duncan of New York City, and a brother, James Atherton."

The Secretary has also learned of the death of Jacob W. Manning on October 29, but has no particulars. His last address was Temple Street, Duxbury, Mass. William B. Willim's address is 116 East French Place, San Antonio, Texas. — WALTER H. KILHAM, *Secretary*, 126 Newbury Street, Boston 16, Mass.

1891

A class dinner was held at the Algonquin Club in Boston, on December 14. Fifteen were present, including our honorary member, Harry Clifford '86. Our other honorary member, Horace Ford, expected to be with us but had to send his regrets. The following attended: Barnes, Bradlee, Brown, Clark, Cole, Damon, Dana, Earl, Fiske, Hatch, Holmes, Howard, Tappan, and Young. Considering that it snowed during the day and was cold and slippery, we did very well; Will Wilder was the only one who accepted but did not show up. Reply cards returned from 20 others practically covered our present active list. They sent best wishes, regards, and so forth, and many of them expressed their intention of attending our 55th victory reunion next June. Harry Young was elected chairman of our victory reunion, which shows that one good turn deserves another, as he did a grand job at our 50th. The tentative dates and place are June 8 and 9, New Ocean House, Swampscott, Mass. You will hear more of this anon. Harry Clifford regaled us with a new class song or ditty which we shall hope to have duly recorded for use at our 55th. All those present seemed fit and in good spirits. Although our ranks are diminishing, it was reported that inroads for 1945 were much lower than for most recent years — time marches on. Letters of greeting were sent to several who were not able to attend the dinner because of illness.

We were notified of the death of James J. Welch on October 26. He came over to see us on our 50th, as he lived near by. He attended the Institute only a short time, and we had little or no other contact with him over the years. The following is from a Boston paper: ". . . James J. Welch, 76, of 32 Washington Square, municipal official and president-treasurer of both James J. Welch & Company and Welch & Moynihan, Salem contracting firms, [died on October 26.] A trust fund commissioner for many years, he also served two terms on the city sewerage commission, was a trustee of the Salem Savings Bank and a director of the New England Road Builders Association. Born in Salem, he attended . . . Technology. He was active in the Philharmonic concerts held here annually, also the annual Read Fund community picnic outings. He leaves a son, J. Norman; a sister, Mrs. Robert Connors of Salem, and four grandchildren."

Giff Thompson wrote the following at the time of our class dinner: "As it will be impossible for me to be present, I will write instead. The time would seem suitable for our Class to call to mind what has been done since the 50th reunion. The war is over. All in the Class were too old to take a part in the late war in the Army or Navy, yet some members were active in giving their thought to the betterment of related conditions and thus sharing in the help needed. May those who are not yet on the retired list lend their mental assistance in the return of more peaceful duties. With this may I extend my warm greetings."

Hartley White wrote from Mount Dora, Fla.: "I'd like to be there and greet the fellows again. But in order to be active at all I have to be where it is warm, hence my sojourn on my three-acre grove here in Florida at Mount Dora on Lake Gertrude. I have about one hundred orange trees, mostly tangerines, and they are bearing a good crop this year."

The following is quoted from a recent issue of the Boston *Herald:* "Roxbury Latin School, oldest continuously functioning private school in America, is celebrating its 300th anniversary. This was the first independent such institution on the North American continent. According to the late Professor George Lyman Kittredge of Harvard, an alumnus, the school is still very close to the model on which it was founded, the Elizabethan grammar school of the type attended by Shakespeare. It is considered 'The American Rugby.' Founder Elliot, apostle to the Indians, created a perpetual endowment so that the school never could be controlled by church, state or wealthy alumni."

In looking over the Quinquennial Catalogue of the Roxbury Latin School, we find the names of 11 men who also appear on the 1891 class roster at Technology. Before those in our Class, very few men from Roxbury Latin went to Tech, and even since then it is doubtful whether any class at Technology has had nearly so many from this school, which has always been considered a preparatory school for Harvard and has specialized on ancient languages, literature, and history. Perhaps the best-known Roxbury Latin alumnus to study at the Institute is C. Francis Allen, Professor Emeritus in Civil Engineering, who was graduated from Roxbury in 1868 and from M.I.T. in 1872. The 1891 men who attended Roxbury Latin were spread over three classes there — '87, '88, and '89. They were Charles Garrison, Henry Fiske, Howard Forbes, Stephen Bowen, Ernest Tappan, and Harry Young, all living, and Louis Boynton, Walter Henderson, Edward Cunningham, Alfred Blinn, and Arthur Rice, who have passed on.

We have heard from Walter Douglass just in time for these notes, and the news he sends with his Christmas card will be of much interest to his many friends: "Back from Fort Belvoir and now located in this early New England town of Dunstable, Mass., I am married again to a lady who was a schoolmate of my early days. We both love the country, so here we are. An old pre-Revolutionary house was the basis of our remodeled home, with views of Wachusett to Monadnock to Crotched Mountain, and farther north. Monadnock is 35 miles away. It sounds interesting, doesn't it? So you had better drop in when up this way, at the center of town on High Street; telephone: Tingsboro 2163. We are glad to see the first New England winter since 1939 — cheerio." — HENRY A. FISKE, *Secretary*, Grinnell Company, Inc., 260 West Exchange Street, Providence, R.I.

1896

The Secretary has received letters from various classmates which have yielded some information. The Youngs had left Bass River, on Cape Cod, by auto on October 13. They had stopped over 10 days in Bridgeport, Conn., and two days with Mrs. T. A. Edison at West Orange, N.J. They had a day at St. Davids, Pa., and a good afternoon and night with the Lou Morses in York, Pa. Con himself contracted a bad case of indigestion and was under the doctor's care in Chevy Chase, Md., for a few days. After that their trip to Florida was apparently without any special incident. Through Irv Merrell word has been received that the Con Youngs are now located for the winter at 123 Valencia Drive, Dunedin, Fla. Marsh Leighton says everything is going well with him and he is willing to go along with whatever plans the secretaries make for observance of our 50th anniversary. Haskell Smith finds that the time passes rapidly with him in attending to the growing up

of three grandchildren, ages three years and under. Clem Tower is definitely planning to be with us at the observance of our 50th anniversary. Admiral Bakenhus was apparently the only '96 man present at the Compton 15th anniversary dinner of the New York Technology Club on December 5 at the Hotel Biltmore. Mrs. Bakenhus went along with him, and he reported that the affair as a whole was quite a success. He was particularly struck by the appearance of those attending and goes on record as thinking that he had never before seen such a good-looking crowd of Technology people together. He also sent the Secretary one of the programs of the dinner, which was most attractive.

Charlie and Bertha Tucker sent cards to both the Secretary and the Assistant Secretary from Bermuda, where they reported that they were having a very enjoyable time. They saw Tilley in New York before sailing. Lloyd Wayne finds it most difficult to get used to having unlimited gasoline, and he had not traveled very far afield. He did make a 10-day stay up at a northern Indiana lake and had made two trips to Cincinnati. He is taking active part in the doings of the Indiana Association of the M.I.T. and says that, although he does not dance personally, he attended the dinner dance of the Association and had a most pleasant evening. He is also having good times at the meetings of the Scientech Club in Indianapolis. These meetings have made him realize how far behind he has become in scientific developments, with the result that he has been reading about the ideas now extant of matter and nuclear physics. He is getting quite a kick out of it and feels that, although he may not understand everything thoroughly, he does get the high spots. Elbridge C. Jacobs, Professor Emeritus of the University of Vermont, reported as of December 1 that winter had arrived in Burlington, with five inches of snow the day before and steady cold weather, but with double windows on and calked, with a tight roof, and a full coalbin, he was prepared for everything. He is already engaged in preparing his next report as state geologist of Vermont.

Bradley Stoughton returned recently from London, where he directed the mineral and metal investigations in Germany of the technical and industrial intelligence committee of the Joint Chiefs of Staff. He was in England and on the Continent for three and one-half months last summer during which time 45 A.I.M.E. engineers were engaged in those investigations. Mike Sturm now has a new address at 1810 Colfax Street in Evanston, Ill.

It is with much regret that report is made of the passing of two of our classmates. Harry G. Fisk died on November 30 in Springfield, Mass. He had not been in the best of health for some time. He had an active and colorful career. He took a prominent part in our student activities, including Chi Phi Fraternity, the Walker Club, and the Yacht Club, and was president of the Athletic Association and undergraduate Class Secretary. His business interests were numerous, largely connected with his home town of Springfield. He was one of the founders of the Fisk Rubber Company. He was much interested in the Colony Club, where he served as president from 1919 until about three years before his death. He was one of the original founders of the Eastern States Exposition. He was an enthusiastic breeder of blooded cattle and until about five years ago kept a fine herd at Wachusett Farm in East Longmeadow. His club connections were numerous. At one time he was president of the Knox Motor Company and the Springfield Brick Company. He took a prominent part in the civic affairs of Springfield. He was married on January 24, 1900, to Alice Billings Mayo. She died in June, 1944. He is survived by three children, Noyes Mayo Fisk of Longmeadow, Alfred Mayo Fisk of Springfield, and Mrs. John G. Winchester of New York City. There are also three grandchildren.

John F. Brooks died on November 6 in North Hanover, Mass., his old home town, in which he continued to reside throughout his lifetime. He kept the general store and was former postmaster, former town clerk, and town treasurer. He was a member of the Masons and Odd Fellows. He is survived by his widow and two sons, John S. of North Hanover and Lieutenant Commander Curtis C., and also a daughter, Mrs. Amy E. Lunder of Seattle. — CHARLES E LOCKE, *Secretary*, Room 8–109, M.I.T., Cambridge 39, Mass. JOHN A. ROCKWELL, *Assistant Secretary*, 24 Garden Street, Cambridge 38, Mass.

1899

Word has been received of the death on December 30, 1944, of William B. Flynn, VI, at his home in Narberth, Pa.

The address of Raymond F. Bennett, I, is Eastland Hotel, 157 High Street, Portland 3, Maine. Herbert H. Dakin, V, lives at 151 Draper Street, Springfield 8, Mass.

From the Alumni Secretary comes an announcement that Saturday, June 8, will be Alumni Day at Technology. It will be of the general nature of pre-war Alumni Days including the Alumni Banquet. Put this date on your calendar now.

These notes are much less voluminous than usual. Ask your conscience if you couldn't have sent your Secretary some information about yourself that he could have used in the class notes. — BURT R. RICKARDS, *Secretary*, 381 State Street, Albany, N.Y. ARTHUR H. BROWN, *Assistant Secretary*, 53 State Street, Boston 9, Mass.

1900

Some of the boys have suggested a class meeting on Saturday, February 23, preceding the Alumni Banquet at the Hotel Statler that evening. Those interested, please notify the Secretary.

A letter from Harry Osgood follows: "I should have written you long ago, thanking you for the picture of our group at East Bay Lodge. I thoroughly enjoyed the occasion. The older I grow, the more regard I have for the members of our Class, probably because I have more time to think of them. Sumner Manley hopes to visit here at the farm. . . . His son Jack is stationed at Yorktown, Va.

"As for domestic affairs, I am still raising hay, but have given up trying to feed the urban multitudes. I don't intend to let any food from this farm get into the hands of any CIO's or AFL's. The farmer has not struck yet, but is doing a big job of curtailment. No help, no wheat, no corn. We have baled over 300 tons of alfalfa, Lespedeza, clover, and timothy. Our home produce is all harvested and stored. Sweet and common potatoes, lamb and pork, vegetables, and fruit, preserves, and so forth, are all ready for winter. Good food, and plenty of it, is my weakness now, but still I remain thin. I am like an ole hound dawg, run it all off. Give my regards to any of the fellows you may be in touch with."

The registrar of former students informs us that Harold S. Conant, VII, died in January, 1942, at his residence in Brockton, Mass. Also from the same source, comes word of the death in April last of Frederick C. Lindsley, I, at Oakland, Calif. He was formerly a salesman for the Jamieson Towle Willoughby Corporation. — George Mead writes from Dayton, Ohio: "Thanks so much for the very interesting and well-prepared report of the June class reunion. I am hoping to be with you at the next one."

Last summer Henry Morris wrote from Washington as follows: "The notice of the 45th reunion sounds very enticing. I know the Lodge and surrounding country well for we have spent many happy summers on the Cape and some of them at the Wianno Club, but I do not believe I can make it this time. I saw Sperry, however, at the Chevy Chase Club, of which we are both members, and we agreed to go to the 50th, if neither death nor taxes prevented. If I could drive, I might make it, as Mrs. Morris and I must go to Maine early in July in the attempt to dispose of her father's property, of which I am enclosing a descriptive circular. You will note that I am a realtor because I believe in joining organizations of people in whose business I am interested. You may also get a letter styling myself as mining engineer, when that stationery is handy or appropriate, and even find me purporting to be an economist, particularly now that economy may become the style again. I well remember our 25th for my particular chum, Frank Chase, was there, and we went to the Cape that time, I believe. I also enjoyed meeting the families of my former classmates, and Mrs. Morris found Mrs. Fitch and her children charming and especially friendly. Please give them our regards if they are among the fortunate ones to go to the Cape.

"I have lived in this hotbed of intrigue and excitement so long that a peaceful life seems too remote to be attainable, but I should like to try it for a while and may have a chance this summer, for we shall stay in Maine until autumn unless we dispose of the property before then. I fought the battle of Washington during the last war until I got to the point of drinking milk for soothing syrup, but this time my only contribution was a few months with the War Department in the attempt to renegotiate contracts, during which time I lost the remains of my disposition and my respect for government red tape. Thanks again, and may the reunion be blessed with a happy crowd and fair weather."

Welcome news came in recently from Brooklyn: Mr. and Mrs. George D. Atwood announced the arrival on November 23 of Cynthia Bennett Atwood. — C. BURTON COTTING, *Secretary*, 111 Devonshire Street, Boston 9, Mass.

1901

At the request of the investment bankers bidding on the sale of the Florida Power Corporation equity, Al Higgins, President of the company, repeated in New York last October the show he had given on the bonds a year and a half before. Members of the Class who resided in New York received an invitation to attend. As before, the story of Florida's industries was told by exhibits, moving pictures, and stereopticon slides, but this time the show was modernized, and Florida's future over the next decade was predicted by the same means.

Roger Wight has sent me a clipping from the November 5 issue of *Life* which reports Al's show in the following words: "A fortnight ago $9,000,000 worth of stock in Florida Power Corporation, a $40,000,000 firm selling electricity in northern Florida, had to be sold on SEC orders and also to expand. Florida Power moved in on New York with a technique which seemed commonplace in Florida but made Wall Streeters' eyes pop. To the company's sales headquarters in New York's Hotel McAlpin came representatives of firms like Kidder, Peabody; Goldman, Sachs; Hornblower and Weeks. There they were confronted with samples of Florida products — coconuts, pine sap, "Miss Florida of 1945" in a bathing suit. F.P.C. executives donned special coats labeled with their titles. A champion drum majorette, who temporarily became Miss Florida Power Corporation, helped turn the big placards which illustrated the sales talks. The abashed Wall Streeters looked and listened. Then a syndicate led by sober Kidder, Peabody, bid a satisfactory $16.26 per share."

It is too bad I can't reproduce the illustrations accompanying the article, as they add considerably to the interest — particularly those of Miss Florida of 1945 (unofficial) and Miss Florida Power (baton-twirling champion), who did their part to help make the affair a success. Commenting in a recent letter on results of the show, Al says: "We got a very good price for the stock, and it all went out of the window immediately; we are now absolutely on our own in the hands of public investors without any holding company affiliation." He adds: "I had a nice letter from Charlie Tufts recently. He is now practically retired and apparently anticipates enjoying life from the side lines. I also had a lovely visit with my old thesis mate, F. Ward Coburn, who seems to be continuing to enjoy the vicissitudes of the blast furnace business."

I regret to have to report the deaths of three classmates: Matthew M. Cushing on October 24, Horace E. Hildreth on November 7, and Stuart B. Miller on December 3.

Philip Moore sent me the following report on the death of Matthew Cushing in the official bulletin of the Wyoming Stock Growers Association: "Matthew M. Cushing, 67, passed away at Denver on October 24, 1945. Mr. Cushing was a native of New England, coming to Wyoming a number of years ago and purchasing a ranch southwest of Saratoga. He added extensive land holdings, and built up and successfully operated one of the finest well-bred Hereford cattle ranches in southern Wyoming. He recently disposed of his ranch and cattle to Willis Walker of the Plains Airways Company. Mr. Cushing was made a member of the Executive Committee of the Association in 1928, and served until elected treasurer in 1931, which office he held until 1941 when he resigned on account of ill health. He is survived by his wife, Nellie I. F. Cushing, a brother, Milton L. Cushing, of Suffield, Connecticut, and a sister, Mrs. Robert F. Leavens, of Berkeley, California."

Theodore Taft forwarded the newspaper clippings quoted below concerning Horace Hildreth and Stuart Miller: "Horace E. Hildreth, 71, of 6 Linnaean Street, Cambridge, a civil and mining engineer, died at his home [on November 7]. Born in Harvard, he was graduated from Harvard College in 1899 and from . . . Technology in 1901 with engineering degrees. He was a civil engineer for bridge design and construction with the New York, New Haven and Hartford and Pennsylvania railroads from 1901 to 1910. He was also associated with other business and manufacturing enterprises in New England and in recent years helped in the development of mines in Colorado. He was an officer of the Blue River Gold Mining Company of Breckenbridge, Colo., from 1937 to 1942. He was a member of the Appalachian Mountain Club, Green Mountain Society, and Wilderness Society. He leaves his wife, two sons, Edwin W. and Lt. Hoyt S., USAAF; a daughter, Mrs. Edwin J. Saxl of Providence, and a sister, Mrs. S. Bruce Elwell of Cambridge."

"Stuart Berwick Miller, 209 East Arch Street, chairman of the Marquette County (Mich.) OPA board since it was established before the war, died instantly [on December 3] at his desk in the OPA office. Mr. Miller, who personally supervised tire rationing, had completed more than 7,000 hours of volunteer service with the OPA, which is believed to be one of the outstanding records in the county. He recently was recommended to the State Defense Council for citation. He stopped at Richard's Sport Shop to chat with friends a few minutes before going to his office. He had been at his desk only a few minutes when he was stricken.

"Born in August, 1877, in Cambridge, Mass., Mr. Miller was 68 years old. He was a graduate of . . . Technology and for 20 years was employed by the Du Pont company as a powder expert in charge of plants in Birmingham, Ala.; Wilmington, Del.; Emporium, Pa.; Deep Water Point, N.J., and Louviers, Colo. He came to Marquette from Birmingham in 1906 and was married to Imogene Rankin on October 27, 1909. In 1911 they moved to City Point, Va., where Mr. Miller served as manager until he assumed charge of the Deep Water Point plant, which manufactured explosives for the armed forces during World War I. In 1923 the family returned to Marquette from Louviers.

"Mr. Miller was a veteran of the Spanish American War, during which he served in the U.S. Navy. He was a member of St. Paul's Episcopal Church and had been very active in affairs of the parish and diocese for many years. He had been a member of the vestry since 1924, was a member of the bishop's council of the Diocese of Northern Michigan and was diocesan treasurer. An ardent sportsman and expert rifle shot, Mr. Miller was a member of the Marquette Rod and Gun Club and Marquette Skeet Club, which he organized. He also was a member of the National Rifle Association and often competed with the nation's experts at Camp Perry, Ohio, being captain of a champion northern Michigan team on one occasion. He was a member of the Marquette Club. He is survived by his wife and son, Berwick, of Marquette, a sister, Mildred, of Cambridge, Mass., and a brother, Lawrence, of Wellesley, Mass." — GUY C. PETERSON, *Secretary*, 788 Riverside Drive, New York 32, N.Y. THEODORE H. TAFT, *Assistant Secretary*, Room 3-266, M.I.T., Cambridge 39, Mass.

1902

Two fall weddings of interest to the Class have come to our notice, those of Pendergast's daughter and Annett's son. Pendergast's daughter, Sarah Niles Pendergast, was married on November 24 to Alexander Bill, Jr., a captain in the Army Medical Corps and son of Mr. and Mrs. Alexander H. Bill of Cambridge. Miss Pendergast is a graduate of Vassar and has recently been working in the Radiation Laboratory at the Institute. Captain Bill was graduated from Harvard and in 1939 from Harvard Medical School. He is now stationed at Camp Butner after having served in Europe with the 79th Infantry. Annett's son, Cecil B. Annett, Jr., a sergeant, and Dorothy Helen Williams of Morristown, N.J., were married on October 17. Cecil, Jr., is a graduate of Williams College and of the Harvard School of Business Administration. — Bob Edwards' son, Charles P. Edwards, who is at present attending the Fletcher School of Law and Diplomacy, has been awarded a graduate scholarship by the faculty of Bowdoin College.

Patch is now in Hawaii and on his way had a chance to look up some of his friends around the San Francisco Bay region. He writes that before leaving Boston he had a letter from Lydia Weld, XIII, who now lives in Carmel, Calif. During the war, she came up to Oakland and made use of her training in naval architecture in one of the big shipyards. In these days of strikes, walkouts, and so on, it is interesting to learn that she missed work but five days in two and one-half years. To better the record, when work slowed down and manpower was still scarce, she swung into harvesting cherries and tomatoes, of which there were tremendous amounts liable to waste for lack of gathering.

Bert Sherman has recently been chosen president of the American Council of Commercial Laboratories. This organization has a membership embracing commercial laboratories throughout the country. — Les Millar is now at 39 Broadway, New York, with the United States Government cost appraisal services. — Norman Borden, who is at the Institute with the Division of Industrial Coöperation, now commutes daily from Salem with your Secretary. Having accounted for the other class officers, it is in line to announce that J. Albert Robinson, who is with McKesson and Robbins at 155 East 44th Street, New York, has been chosen to fill the office of class treasurer, which became vacant through the death of George Seabury. — BURTON G. PHILBRICK, *Secretary*, 246 Stuart Street, Boston 16, Mass.

1903

While few of the Class — in fact, only two, W. H. Adams and A. S. Ackerman, are listed as active — got into the active services of Army, Navy, and Air during World War II, a great many served in the Reserves as consultants and advisers and in research work. Among these, perhaps one of the leaders, although he says he just kibitzed, was R. C. Tolman, normally dean of the graduate school of the California Institute of Technology. The Army called him as one of its principal consultants in the development of the atomic bomb. Colonel Clyde Matthews, Army public relations officer, says, "It fell upon him to investigate the difficult scientific problems faced by Major General L. R. Groves," and adds that he was able to do this "because of his knowledge and the profound respect in which he is held by other scientists." He further describes Dr. Tolman as "an elder scientific statesman." The Washington, D.C., *Times-Herald*, from which these notes are culled, interviewing him in his office in Washington, describes him as "a tall, lean, good-looking man with kindly eyes," who warned against "expecting too much of atomic energy in the postwar world. People should not sell out their oil and other stocks in anticipation of a brave new world of scientific wonders. The development of atomic energy for peace uses is still a long, long story." The *Times-Herald* further states: "Dr. Tolman is considered the Nation's foremost authority on ionization, colloids, the relativity of motion, on metallic conductors, the principle of similitude, the quantum theory, statistical mechanics, and, before we run out of breath, cosmology and relativistic thermodynamics."

It is planned to have a special alumni observance on Saturday, June 8, at the Institute. This occasion will have many of the features of the pre-war Alumni Days and will be a grand chance to get together at noon for luncheon and finish with a banquet at the Statler. Although it is not a fifth year for our Class, we urge you to note the date and try to attend one or more of the events. — Frederic A. Eustis, *Secretary*, 131 State Street, Boston 9, Mass. James A. Cushman, *Assistant Secretary*, 441 Stuart Street, Boston 16, Mass.

1907

On December 2, Frank MacGregor, dubbing himself as my "Wilmington correspondent," wrote me to say that a recent number of *House Beautiful* had a full-page picture of Sam Marx and a write-up about him, and also that the *New Yorker* for December 1 reported an interview with George Otis regarding bluestone. In this village of Whitinsville where I live, I was unable to get a copy of the magazine first mentioned, but I have the other issue referred to. It seems that the old Vanderbilt mansion at Fifth Avenue and 51st Street, New York, is to be razed. The pavement abutting the Fifth Avenue frontage contains a single slab of bluestone 15 by 25 feet, the like of which, so the magazine story says, could not be secured today. George Otis paced it off in the presence of the reporter and stated that it is the largest single paving block in the city and maybe in the world. He is quoted as saying that a fair secondhand price for it would be $1.80 a square foot, over and above the cost of prying it up and hauling it away, which would mean about $675.

Late in November, I received from Emory G. Hukill a letter from which I quote: "I did not expect to receive such a long and gracious thank-you note for my contribution to the Alumni Fund. . . . You ask what I have been doing during these last few years. . . . In 1935, while an officer of three oil companies, doing business by tank car only, I met with an accident that nearly cost me my life. From being left along the road for dead, I finally got myself together and in December of that year was driven to Florida to recuperate. I came home and the next fall was driven to California, changed trunks for suitcases, and against doctor's orders started on a little trip around the world — one side of me as good as gold, the other only 10 per cent efficient. After riding the trains and rickshas in Japan and China, the buses in Bali and Java, the camels in Cairo, and after fights with the customs in Germany, Sweden, and Norway, I finally came home in the summer of 1937 with 12 suitcases and three bales of rugs. . . . Then in 1938 and 1939, I took a trip around South America and another trip around the world in the *Stella Polaris*, through the South Seas, Africa, and so on, in a different direction. Needless to say, I have traveled all over the United States trying to find some place or some thing that will benefit me. I like New Hampshire summers and winters in Texas or Arizona. . . . I am nothing but a gentleman of leisure these days. My son-in-law is back from the Army in the Pacific, and my son, formerly with Harshaw Chemical Company as an engineer, worked on the atomic bomb. I am an old grandpap by virtue of three boys and one girl." Emory's address is 2524 Guilford Road, Cleveland Heights 18, Ohio.

In The Review of November, I wrote briefly of Jack Kinnear. I was somewhat puzzled about his home address being in Nevada while his business was in New York and so wrote to him seeking enlightenment. From his letter of November 28, I learn that his business office as vice-president of the Kennecott Copper Corporation is at 120 Broadway, New York, and he lives, when in the city, at the Carlyle Hotel. He maintains his home and residence in McGill, Nev., to which he plans to return when his retirement date arrives, so that he can fulfill certain extracurricular duties, such as presidency of the Nevada state board of education and of the Nevada Mine Operators Association and chairmanship of the Nevada governor's advisory mining board. Mail should be addressed to him in care of the Kennecott Copper Corporation, 120 Broadway, New York 5.

On December 19, I telephoned to Roger Gale at his home at 32 Bishop Road, Wollaston, Mass., and found that on last April 1 he had left the Sanford Mills in Reading, Mass., where he had been since 1911, and become chemical director of Howe and French, manufacturers of paints, oils, and chemicals, at their factory in Weymouth, Mass. Roger has a son, married, who lives in Reading, Mass., and a married daughter living in Hartford, Conn.

On December 21, Paul Cumings wrote to me on the letterhead of the home office of the John Hancock Mutual Life Insurance Company, and I quote: "In the November Review I noted that my good friend, Stan Wires, mentioned that we are no longer associated in business. . . . Since last April I have been at the home office here in Boston. My position of construction consultant is a new one with the company. Since beginning work, a substantial part of my time has been spent in planning for the erection of an addition to the present home office building. Although this is referred to as an addition, it really is a unit in itself and will in no way resemble in exterior appearance our present building. . . . Twenty-six stories high, topped by a lantern tower . . . the building will be one of the largest in Boston and only slightly lower than the Custom House tower, the city's highest. . . . I cannot boast of any grandchildren but do have three children. Only one, an 11-year-old son, Bob, is at home with us. My daughter, Helen, is a student at Wheelock College in Boston and will receive her degree next June. Lee, my older son, entered Technology last July after three years at preparatory school in Lenox. He is a member of the Technology swimming team and has competed in the two college meets held thus far this year. . . .

"Though really a club note, it may interest you to know that early in November a few of us living in Wellesley, Mass., decided that there were enough Alumni in the town to form a club. A canvass showed that about 150 Tech men live there. Of this number about 50 responded and attended the first meeting, with classes from 1898 to 1944 represented. It looks as though there were sufficient interest to make a real start. Stan Wires is one of the committee to draw up by-laws to be presented at the next meeting." — Bryant Nichols, *Secretary*, 23 Leland Road, Whitinsville, Mass. Harold S. Wonson, *Assistant Secretary*, Commonwealth Shoe and Leather Company, Whitman, Mass.

1909

Molly Scharff, XI, VII, is back home in Washington, and this is what the Colonel says in a letter dated December 9: "I was in Germany for about five months on this last trip — one month at Frankfurt as deputy chief of the production control agency, at Supreme Headquarters, Allied Expeditionary Forces, and four months at Berlin as deputy director of the industry division of the United States Group Control Council (later the industry branch of the economics division of the Office of Military Government for Germany). During the latter assignment, I served either as member or alternate on four of the quadripartite committees — on industry, fuel, the level of industry, and liquidation of German war potential. I had a most interesting time arguing with the British, the French, and the Russians, and made some good friends among them. It was interesting to have every word spoken by each member translated into two other languages. I left Berlin on October 31 and landed from the 35,000-ton *West Point*, formerly the *America* of the United States Lines, at Newport News on November 13. I am now on terminal leave and have as yet no civilian plans or address, although I shall soon have to be thinking about them.

We have received a cable from Samuel announcing that he was sailing for home — we don't know by what ship nor when he'll arrive, but probably too late for Christmas. Jeanne and I are delighted anyway." That's a splendid report on the men of the Scharff family— what, in fact, you might have expected. And we all hope, indeed, that Samuel, the Fried Clam Kid, got home for a Christmas reunion.

The Review Secretary is also glad to announce that both of his children are back again on civilian status. About the middle of September he received a letter dated September 1 from Laurens D. Dawes, a lieutenant commander, stating that the letter was being written while sailing into Yokohama Bay and that it would be one of the first from our occupation forces to be mailed from Tokyo. Sure enough, it was dated Tokyo, September 2, and had two cancellations, one in English and another in Japanese hieroglyphics. Since then Laurens has come back to this country via the West Coast, is on terminal leave, and has returned to his old company, Munsingwear, of Minneapolis, where he has been promoted to the position of assistant comptroller. Jane and her husband, Major John H. McClennan, have spent the past year and more at Warner Robins Field, Georgia, where his duties were concerned with radar in the Air Forces. He is now on terminal leave and has returned to the Niagara Hudson Power Corporation at Syracuse, N.Y., where he is an electrical engineer. Their daughter, Joanne, is now well over a year old and has developed quite an up-and-coming personality of her own.

Some day when you are in an expansive frame of mind and would like to see one of your classmates playing to perfection the role of host, wangle for yourself an invitation to lunch from Reg Jones. Reg's office, in the Bell Laboratories office on West Street along the Hudson River water front in Manhattan, is all windows. It faces the west, is on the 12th floor of the building with an unobstructed view of the Hudson with all its crowded shipping. When I (Paul) was there the other day, a Liberty ship, rather grey and grim, was going up the river to land her cargo of returning G.I.'s, who were crowding every point of vantage above deck: boats, gun stations, and even rigging. Reg's office is a huge room with lofty ceiling and lots of space. He was entertaining besides myself a man who had been talking to him about a scheme that might be used by the Class to add to the Class of 1909 Scholarship Fund of which you will be hearing a little later. Near the windows was set a table with three places, and there we were served a delicious lunch that seemed to come out of nowhere. It just appeared like magic. So, for the perfect host, Reg is your man!

Clark S. Robinson, X, a colonel, has sent in a copy of a report he has prepared entitled, "The Present Status of the American Table of Distance." It deals with the experience of the Army in gathering data about explosions and how far away from stores of explosives other stores may be regarded as safe from damage. Data from 117 explosions have been used to draw conclusions. Certainly a Course X graduate is well qualified to undertake such a study, and we can all hope that Robby never has to get in the danger zone. Some of the data go back to 1882. Robby is stationed in Chicago in the Ordnance Department. One of the sentences is worth noting: "Just what explosives of the atomic type will require makes the issuance of this paper more tentative than ever." That's a poignant statement to read in the year of 1945–1946! — Paul M. Wiswall, *Secretary*, 90 Hillside Avenue, Glen Ridge, N.J. Chester L. Dawes, *Review Secretary*, Pierce Hall, Harvard University, Cambridge 38, Mass. *Assistant Secretaries:* Maurice R. Scharff, 3860 Rodman Street, Northwest, Washington 16, D.C.; George E. Wallis, 1606 Hinman Avenue, Evanston, Ill.

1911

Early in December I had a telephone call from Carl Richmond, I, saying he was on the outskirts of Gardner and wanted me to lunch with him. So we had a fine lunch together, and I was so glad to hear from him that the Legion of Merit award was being given to him in Boston on December 14, "for exceptionally meritorious conduct in the performance of outstanding service from January, 1941, to August, 1945."

George Sullivan, X, President of the Independent Coal Tar Company of Boston, died at Phillips House on November 25. A resident of Belmont, he leaves a wife and two married daughters. He had never been active in class affairs, having been with us for but two years at the Institute.

Two more third-generation members of the Class have appeared, for on November 28 in Dayton, Ohio, a daughter, Susan Alexander, was born to Lieutenant and Mrs. Franklin P. Seeley, and at Worcester on December 16 a second son, John Newell, was born to Corporal and Mrs. Peter Barton (Helen Elizabeth Denison). Speaking of Nat and Louise, their annual Christmas card just arrived — an informal one of Nat and his young grandson, Frank's first child. Nat writes that Frank (M.I.T. '42), who has been at Wright Field, Dayton, Ohio, since graduation, expects to get his Navy discharge by February.

And again speaking of Christmas cards, that airplane card depicting Luis de Florez driving a jet-propelled plane, with a reindeer head in the propeller spot, is another Christmas dandy — the plane being marked *Kami-Klaus-MK II*, Office of Research and Inventions. His headquarters now are at the Bureau of Aeronautics, Navy Department, Washington, D.C.

When an announcement reached the Chamber here of the replacement of the War Production Board by the Civilian Production Administration, I noticed a paragraph about Clarence Woodruff, in charge of the Bureau of Field Operations, and sure enough, it's our Woodie Woodruff, X. In response to my inquiry, he wrote as follows: "A few months before Pearl Harbor I undertook to help the Office of Production Management in its efforts, and later, when the W.P.B. was formed, I went into that. I held various jobs with W.P.B., such as those of chairman of the Production Urgency Committee for Central Connecticut, Deputy Vice-chairman and later Vice-chairman for Field Operations, and then when W.P.B. was discontinued and its functions transferred to C.P.A., I again went along with the change and am now here in Washington as director of the Bureau of Field Operations. Frankly, I look forward to the time when I can get back to my farm at East Hampton, Conn., and from the present outlook I think perhaps I can make the grade by March or April of 1946."

I was certainly delighted to learn in a letter from Jess Frazier, Don's wife, that Don is back on his feet in fine shape now after a long illness down there in Richmond, Va. Jess said that she, too, was rather weary after devoted war efforts — as supervisor on the 6:00 to 10:00 A.M. shift of the First Fighter Command, she was getting up three mornings a week at four o'clock and also was treasurer of the Commonwealth Chapter of the Daughters of the American Revolution, the largest chapter in the state of Virginia. "I am sure," she said, "that the war has taught the women in the South that they can get along without servants, although they may not like it." She added that Don, in addition to his regular details with the American Mutual Liability Insurance Company, of which he is district manager, is busy interviewing many boys for Technology and finds most of them very fine chaps. Don is honorary secretary for the Institute there in Richmond. Among other duties — she is now regent of her D.A.R. chapter — Jess, now that the filter center is closed, is doing work in the arts and skills corps of the American Red Cross and goes to McGuire General Hospital (for amputees) every Thursday. "Denny," she continues, "the war may be over, but it is far from over for many, and I only wish everyone could visit, just once, an amputees' hospital." She and Don are planning to attend our 35th on May 31, June 1 and 2 at a Cape region hotel to be announced. Be sure *you* plan to, also!

A nice letter recently came from Lloyd Cooley, X. He and Teva are still at 7438 Kingston Avenue, Chicago 49, and he is traveling for the Factory Mutuals — his note came from South Bend, Ind. He said he was about to go through the Studebaker plant, where lots of nice shiny new cars are on the production line, but the Warner Gear strike is holding up the needed transmissions. He said he was sorry to miss George Kenney when he came through Chicago this fall.

Charlie McManus, I, has sold his house in Squantum and moved to 46 Regent Road, Malden 48, Mass. Out in Reno, Jim Greenan, II, has reformed his original Greenan and Company, Inc., after its several years as Greenan-Kerr, Inc. Jim's company offices are still in Room 303, 206 North Virginia Street, Reno, Nev.

A geographical breakdown of Fund contributors in the current Alumni Fund VI shows some interesting figures. As might be expected, the best percentage participation by classmates is in the 30-mile Boston radius, but the mid-West is but two percentage points behind, with metropolitan New York two points behind that — pretty close. The figures: Boston and vicinity, 39 of 90, 43 per cent; mid-West, 19 of 46, 41 per cent; metropolitan New York, 21 of 54, 39 per cent; East Coast below New York, 18 of 51, 35 per cent; New England outside Massachusetts, 11 of 36, 31 per cent; outside United States, 5 of 17, 29½ per cent; Massachusetts outside the Boston

area, 9 of 31, 29 per cent; New York State outside the metropolitan area, 4 of 15, 27 per cent; the Southwest and Far West, 6 of 35, 17 per cent; and United States Territories, 1 of 6, 16½ per cent. Entire Class, 133 of 381, 35 per cent.

We haven't been able to settle on a hotel for the 35th reunion yet, but O. W. Stewart, I, is right on the problem and expects a decision soon, at which time the first publicity will go out. Meanwhile save the dates: Memorial Day week end — May 31, June 1 and 2. See you then. — ORVILLE B. DENISON, *Secretary*, Chamber of Commerce, Gardner, Mass. JOHN A. HERLIHY, *Assistant Secretary*, 588 Riverside Avenue, Medford 55, Mass.

1913

As of December 14, in the 1945–1946 Alumni Fund, we had reached 90 per cent of quota in the number of contributors and 74 per cent in dollars. This record is under the average of our contemporary classes. One hundred and thirty-one of us gave $2,480, an average of $19 each. Our goal was 145 men to give an average of $23. Please remember this and do something about it when you write your next check payable to the Alumni Fund.

Jack Coe, X, was recently made one of the five vice-presidents of United States Rubber Company. This is a huge company, and Jack has a big job in it, in charge of one of their principal manufacturing divisions. Since the foregoing was the only item of news available, I appealed to Al Townsend, at the Institute, for more, and here is what he wrote: "I was glad to get your note of the 14th and to learn that you're as busy as the rest of us in this reconversion picture. As far as class notes are concerned, I have only one or two items, but you can probably expand those as usual. Jim Russell came over a short time ago and browsed through my library, finally selecting a volume or two which apparently appealed to his scientific eye, and I just missed seeing him. I have hopes of being in when he returns the books. Jim is rather busy on special work at his plant and doesn't drop over to the Institute as he did before the war.

"B. L. Cushing came in and paid me a visit the other afternoon. As you know, he is the head of the science department at the East Boston High School. He still commutes from down around Rockland and comes up every morning with two or three Boston teachers who reside in that area. We talked about his son, who is coming out of the service and looking for a postwar job. I had a letter from Ed Cameron the other day and should have answered it long before this. Probably after he calls me up about it, I will finish the job. That is the way we seem to do business in this reconversion. The regular gang of Nat Sage, Joe MacKinnon, E. M. Bridge, Karl Briel, and myself still see one another in the corridors and give a lusty cheer for the Class." — FREDERICK D. MURDOCK, *Secretary*, Murdock Webbing Company, Box 788, Pawtucket, R.I.

1914

The event of the month was the dinner given by the Technology Club of New York in honor of Dr. Compton's 15 years as president of Technology. It was held at the Hotel Biltmore in New York on December 5 and was a very gala affair. A quick check-up seemed to show that 1914 had the largest attendance of any class. As is our usual custom, a cocktail party preceded the dinner. To say that it was arranged by Charlie Fiske is sufficient to prove that it was a very splendid affair. Those attending the event were as follows: Mr. and Mrs. Affel, Mr. and Mrs. Fiske, Mr. and Mrs. Hadley, Mr. and Mrs. MacCart and niece, Mr. and Mrs. Owen, Mr. and Mrs. Simpson, Faunce with his son Jack, who is a naval lieutenant, Covitt and his son, who is an Army captain, Admiral Richey, H. T. Chandler, Ober, Peaslee, Perley, C. L. Smith, Warren, L. A. Wilson, and your Secretary. Mr. and Mrs. Goldenberg had planned to attend but were prevented from coming at the last minute. Admiral Richey said that Jim Isaacs attended the dinner, but your Secretary did not see him. Walter Keith and Norman MacLeod were both in New York at the time but were unable to be present. Walt Keith reported that his dental rubber business was still thriving in spite of some difficulties in getting materials. MacLeod came over to the hotel but was unable to locate the party due to poor posting on the bulletin board. Mac is a director of the National Association of Manufacturers and was in New York in connection with their meetings.

One regular attendant at these New York meetings was unable to be present because he had been confined for several weeks at the New York Hospital. Tom Duffield, one of the most active members of the Class, has had the misfortune to be hospitalized and expects to have to stay there for several weeks more. He hopes, however, by the time these notes appear to be back at his home at 525 West 238th Street, New York City. It is a sure bet that Tom would welcome a greeting from any classmates.

Just as your Secretary was leaving his hotel for the Technology Dinner in New York, a telegram arrived telling of the death that morning of one of the most colorful members of the Class — Porter Adams. This was announced at Charlie Fiske's gathering, and appropriate tribute was paid to Porter.

During his undergraduate days, Porter Adams was known to but a small group of us, having registered as a special student to specialize in aeronautics when he transferred to the Institute from the University of Redlands, Calif. He took but small part in undergraduate activities. Since leaving the Institute, however, he had been one of the most enthusiastic members of 1914, whose attendance at class affairs was hindered only by ill health during recent years. At our war-belated fifth reunion, held actually as our sixth, it was Porter who provided the airplane demonstration at Sudbury, Mass. It was he who arranged with the Secretary of the Navy and the then Captain, now, Admiral King for the fleet of submarines on which we cruised out of New London on our tenth reunion. No member of the Class who attended them will ever forget the part Porter played in the series of annual dinners held at the Engineers Club in Boston.

Born to a lesser estate, Adams would have been a skilled mechanic and inventor of note. As it was, however, he had several inventions to his credit. He was flying his own plane even before he entered the Institute. His energy and fertile imagination were directed to organizational and promotional fields, almost exclusively in the public service. To attempt to list his activities would require more space than is available here, but some items are especially worth noting. Before World War I, he was associated with Don Douglas in planning a round-the-world flight together, but the war intervened, and he entered the Navy, eventually rising to the grade of lieutenant commander. In later years he held the rank of colonel in the Vermont National Guard. His public offices included those of selectman, member of the Vermont legislature, and a host of committee chairmanships such as that of the Boston Municipal Air Board. He was the recipient of two honorary doctorates and in 1934 was inaugurated president of Norwich University. Although ill health forced him to resign five years later, during his short term he was credited with having revitalized the University and initiated the steps which resulted in a 60 per cent increase in the student body. He was a past president of the National Aeronautic Association and for many years served on its executive and other committees. It was while in Washington serving with the N.A.A. that he met Sue Shorter, who became his wife and survives him. Only this year she, too, qualified as a pilot.

Rucker Bristow, one of the principals of Citrus Concentrates, Inc., at Dunedin, Fla., has had the very great misfortune of having his business completely burned out in a three-million-dollar fire. Rucker hopes that he will be able to get governmental release on materials so as to re-establish his plant, which has already made a reputation in the preservation of citrus fruit juices. Many of the Class will recall that the *Saturday Evening Post* a short while back wrote up the story of Citrus Concentrates and the vast improvements it has made in food technology. In writing to your Secretary, Rucker has sent this word in warning: "Let me urge you to do all in your power never to have a fire. You have no idea of the number of valuable papers that you carry in a place where they can be lost nor of how difficult it is to replace these documents, even without considering the expense."

The American Society of Civil Engineers has awarded the annual Hilgard prize for the best paper on flowing water to L. Standish Hall. This is one of the country's high engineering honors, and it is the second time that Hall has won a national competition. He had previously received the Collingwood prize for an article on surface water flow, based on a study of California streams. Hall is the principal hydraulic engineer of the East Bay Municipal Utility District and has his office in Oakland, Calif.

Not long ago the Westinghouse Electric Corporation purchased the B. F. Sturtevant Company of Boston, of which Gardner Derry was vice-president in charge of sales. Knowing that a number of Westinghouse men were taking over some of the Sturtevant activities after the consolidation, your Secretary was very anxious to find out what had happened to Derry and was

delighted to learn that Derry is now vice-president and general manager of the Sturtevant Company. Derry is one of the few 1914 men who is still with his original organization. He started in an apprentice course, proceeding through their shops, their research engineering, and their sales, to become a department manager, then vice-president, and now general manager. His company will continue in the general cooling and air-conditioning business plus their line of industrial blowers and will add the precipitron of Westinghouse.

Two daughters of classmates are freshmen this year at Wellesley College. They are Nancy Dickson, daughter of Ross Dickson, and Nancy Dunn, daughter of Frank Dunn. Sons of the Class, please note! And speaking of schools, Percy Benedict has joined the staff of the Tilton School at Tilton, N. H.

Lucian Burnham, a colonel in the Marine Corps, is back in the United States and is temporarily located in Pasadena. Burnham has seen service in both the European and the Pacific theaters. — Bert Hale, who was temporarily located in Manchester, Conn., during the war, has returned to his old stand at Hudson, Mass. Bert's son was an Army pilot throughout the war.

On Saturday, June 8, the Institute will re-establish its former custom of holding an Alumni Day at Technology. The usual forenoon symposium will be followed by the luncheon at noon, by special features in the afternoon, and by the annual banquet at the Hotel Statler in Boston in the evening. Although this is not one of our regular reunion years, a considerable number of 1914 men from the greater Boston area will probably attend. Mark the day on your calendar as a good one to be in Cambridge. Travel conditions and general developments permitting, we shall probably hold our usual preprandial meeting. — H. B. Richmond, *Secretary*, General Radio Company, 275 Massachusetts Avenue, Cambridge 39, Mass. Charles P. Fiske, *Assistant Secretary*, 1775 Broadway, New York 19, N.Y.

1915

Many thanks to all my classmates who so kindly remembered me with those thoughtful Christmas greetings. These old friendships certainly do improve with the years.

It has been definitely decided that we shall have a Victory Reunion, probably on the week end of May 31 — and probably on Cape Cod — hopefully at Oyster Harbors Club, Cotuit, where we had that memorable 25th reunion. As soon as the "workhorse" committee of Max Woythaler and Weare Howlett makes a definite report, we'll bombard you with notices and plans. In preparation for this, on November 22 at the Technology Club, 24 East 39th Street, we had a New York class dinner. The remarkable attendance of 29 attests the splendid spirit and loyalty of our men. We had classmates from New York: Piza, Durkee, Stearns, Hart, Swain, A. A. Cook, Fred Cook, Walcott, Baker, Lassen, Toabe, Andy Anderson, Williams, and Marion; from Philadelphia: Herb Anderson, Daley, Charlie Putnam, Whiting, Huff, and Schneider; from Connecticut: Alan Dana; from Boston: Howlett, Frank Murphy, Pirate Rooney, Woythaler, Sheils, Eisenberg, Ed Sullivan, and Mack.

This was a gay reunion. Welcome back home from the wars was St. Elmo Piza, who entertained us in his inimitable way with after-dinner stories. His wartime experiences in London certainly have added to and polished up even his former superlative style. But Herb Anderson of Philadelphia ran him a close second, followed by Speed Williams with competing humor. Weare Howlett gave a brief report on preliminary reunion plans for the week of May 31 somewhere on Cape Cod. Doug Baker spoke briefly, but seriously and intently, about his observations on the impoverished living conditions in war-torn Europe. He is shortly returning there for further work. We all missed one of our regular attendants, Gene Place. But against that we're glad to congratulate Gene on his new promotion. On November 26, Gene was appointed general sales manager for the American Mutual Liability Insurance Company in Boston. From a newspaper clipping we quote: "Mr. Place joined the American Mutual in 1930 and for the past 11 years has occupied various executive positions in the sales department. In 1935, he became sales manager for the New England territory. In 1938, he was named to head the company's Atlantic division in Philadelphia, and in that same year he was elected resident vice-president of the company. In 1942, Mr. Place was made sales manager of the New York division. Mr. Place is well known in insurance circles and has been particularly active in national and state safety work. He has been director of the Massachusetts Safety Council, chairman of the engineering section, Massachusetts Safety Council, and secretary and chairman of the textile section, National Safety Council. He is a member of the American Society of Safety Engineers."

On January 1, Charlie Williams is resigning his position as commissioner of Borough Works, Borough of Manhattan, City of New York. All the best to Charlie in whatever new engineering work he enters. After the New York dinner he wrote as follows: "I had a grand time seeing you and everyone else. It was a swell party, and you and the rest of the Boston crowd rate a lot of credit and thanks from us New York guys for sparking the whole show. I'm looking forward to next June!"

You chaps who knew and remember Ted Friebus will be sorry to know that his absence from the New York class dinner was caused by a coronary thrombosis attack which has laid him up for some time at his home, 39 Lake Avenue, Red Bank, N.J. We all wish Ted a speedy and complete recovery. Ed Waldron, a captain in the Military Government, is frozen over in Germany until February. His wife wrote us that he would be unable to attend the New York class dinner. He may have some war experiences he can relate on his return. Henry Daley brought with him, from Philadelphia, Charlie Putnam, who thus made his first appearance at a class dinner since graduation. The years have been good to Charlie; he looked and acted just about the same as in the old days. From the Tech Club many of us went up to Ralph Hart's apartment, where, as usual, he was a superhost providing entertainment, and everything that went with it, into the small hours. Our thanks to Ralph.

From Herb Anderson in Philadelphia we received this note: "The party at the quarters of the Technology Club of New York was a fine affair, and I was particularly happy to meet Charlie Putnam, whom I last saw on the steps of Rogers in 1915. . . . In Philadelphia we are now planning for a record-breaking annual meeting in the Burgundy Room of the Bellevue-Stratford, and it seems particularly fitting that our membership in this area has reached an all-time high of 230 members. This is especially interesting when we realize that Dr. Compton is celebrating his 15th anniversary with the Institute. . . ."

Congratulations and best wishes are due Warren C. Whitman, who on November 1 joined C. L. Jones and Company to make the firm Jones-Whitman and Company, at 131 State Street, Boston 9. Whit is well known in the food industry, having been manager of the confectionery supply department of the H. A. Johnson Company of Boston since 1915. — Frank Scully has resigned from the United-Carr Fastener Corporation and is devoting all his time to his own firm, the Scully Signal Company, 88 First Street, East Cambridge 39, Mass. — Stanley Osborn, commissioner of public health for the State of Connecticut, invites any of us to come down to a healthy state. He says his brother, Franklin Osborn, 2d, '11 had a write-up in the 1911 class notes in The Review, and Stanley says, "Dennie surely runs you a race for class notes honors!" — Here's loyalty for you! Despite personal illness, wartime loss of help, threatened labor troubles, and income tax payments, good Ben Neal comes through for the Alumni Fund with a substantially larger check than last year and a promise to help on reunion expenses later.

Reliable Jerry Coldwell writes from Ford, Bacon and Davis, Inc., operators of the Arkansas Ordnance Plant, Little Rock, Ark., as follows: "I am sorry not to have been in New York for the class meeting — I'd like to have seen the boys. . . . Last night we transferred the Arkansas Ordnance Plant back to the government and now have no property accountability whatsoever. Our accountants will be here for a month or two but that phase is pretty much routine. When I leave tonight, the indications are that I'll not be back — certainly not on this job. In our business, of course, it is a bit difficult to say where you are going to be at any one particular time! . . . I'm not going directly back to New York as I have some other jobs to check, hence am taking the train instead of flying. Weather's poor — ceiling is down to the housetops, and no planes will be out of the hangars today. For once I don't care."

Here's one of our classmates who feels that after having done a constructive job it's time to quit. From Charles E Locke '96 we hear this report: "After 20 years as president of the Colorado School of Mines, Melville F. Coolbaugh has tendered his resignation, effective January 1, although he will remain after that time if a successor has not been selected. Since Dr. Coolbaugh's period as president began, the Colorado School of Mines has taken a foremost place among the engineering schools of the world and has concentrated its training on mineral engineering exclusively. The curricula have been strengthened, en-

trance requirements made more rigid, and the scholastic standards of the school generally raised. Summer field courses in the major fields and in plane surveying have been inaugurated or emphasized so that they now characterize the school. During his tenure the department of geophysics has been organized, and two separate options, refining and production, have been developed in the department of petroleum engineering. During the past three years, research has been conducted that has resulted in the establishment of the intensive course in English for foreign engineering students which has received national and international acclaim in the field of rapid language teaching. The summer session has been organized as an integral part of the school year and the *Quarterly* of the Colorado School of Mines has taken its place as one of the scientific publications of the country. More than $1,000,000 has been spent in addition to the physical plant; state financial support for the school has been greatly increased and placed on a more permanent foundation through additional mill levies. The enrollment of the school has increased from about 375 students to a capacity size of from 750 to 800. As a member of the State Planning Committee and the State Mineral Resources Board and secretary of the Colorado Geological Survey, Dr. Coolbaugh has been prominent in mineral and other industrial developments of Colorado. He is chairman of the organization of Presidents of Institutions of Higher Learning of Colorado, which he organized nearly 20 years ago. During the war he was regional representative of Region 11, of the War Manpower Commission for the Engineering, Science, and Management Defense Training Program. He has been treasurer of the board of the Colorado Industrial Development Research Program since its establishment early in 1945."

It is very sad to report the passing of Phil Alger's wife, whom we all knew at Technology as Catherine Jackson, daughter of Professor Emeritus Dugald C. Jackson. Phil wrote that she had died very suddenly on September 2, while they were all vacationing in New Hampshire. Her last book of poems, "Romany Rhymes and Domestic Ditties," will be published early in the year. From Phil's letter I quote the following: "My son, John, is now a freshman at Technology and has joined Theta Delta Chi fraternity. . . . I have a second grandchild, born on October 29 — Catherine Langdon Prince, who, with her mother, Mrs. D. C. Prince, Jr., and the two-year-old son, Timothy Chandler Prince, is visiting me in Schenectady this Christmas. . . . I shall hope to see you sometime when I am in Boston next year." Our sincere sympathy to Phil and his family.

Nice going for the Alumni Fund. One hundred and fifty-seven men (90 per cent) have given $3,294 (112 per cent) or an average of $21 a contributor. These are our highest totals in the six years of the Fund. Many thanks, many blessings to you all for your generous and loyal help. You have all done a lot to "help Azel." Now do something to help yourselves. Plan to come to the 1915 Victory Reunion. — AZEL W. MACK, *Secretary*, 40 St. Paul Street, Brookline 46, Mass.

1916

Nat Warshaw has joined the Market Forge Company, establishing a standard department for materials handling equipment. At the time of our last reunion he was president and chief engineer of the Service Caster and Truck Company of New England.

Classmates should note that there is to be a special Alumni observance on Saturday, June 8, at Technology with an open-air luncheon at noon, and an Alumni Banquet at the Hotel Statler that evening. Doubtless our class reunion, which we hope will be held at the Oyster Harbors Club on Cape Cod, will immediately precede this Alumni gathering at Cambridge. — JAMES A. BURBANK, *Secretary*, The Travelers Insurance Company, Hartford, Conn. STEVEN R. BERKE, *Associate Secretary*, Berke-Moore Company, Inc., 11 Boylston Street, Brookline 46, Mass.

1917

Bob Marlow has written us: "I left Bethlehem last August and took a position as safety engineer here at the Fort Dix Air Base. I am enjoying the work immensely." The letter came from the ground safety office there.

More about P. Y. Hu, who is engaged in work in a steel plant in Pittsburgh — he reports that after working in the daytime he is taking four subjects in the evening school of Pittsburgh University, including x-ray diffraction analysis of metals, liquid steel control, advanced metallurgical calculations, and industrial planning and control. He is apparently one of our busiest members.

Robert Murray Blackall is in the Northampton, Mass., news as manager of a growing concern, the Clement Company. And a change-of-address notice reveals that Edwin J. Grayson, formerly a captain, is now entitled to wear the gold oak leaf.

Forrest Sherman, a rear admiral, was in town on December 12 on a Navy assignment that called for his presenting a document of Navy recognition to a Boston organization. He visited his mother in Melrose and then flew back to Washington. His daughter, Helen, was recently married to a naval lieutenant in Washington.

Your Secretary took a hospital vacation — nothing serious — and had an opportunity to try out Rudy Beaver's surgical blades. The results were excellent and were thus reported to Rudy when he paid a surprise visit to the so-called patient a few days later. — RAYMOND STEVENS, *Secretary*, 30 Memorial Drive, Cambridge 42, Mass. PHILIP E. HULBURD, *Assistant Secretary*, Phillips Exeter Academy, Exeter, N.H.

1919

Dr. R. S. Hunt in his letter received in December says that his status remains unchanged, "except for a few gray hairs and several more pounds." He practices medicine in Auburndale, Mass. He adds: "I wrote a few notes on the card which I am enclosing. In the notes I neglected to say that among the inhabitants of our house we have two Siamese kittens. Apparently the kittens resented the omission, as this card offers mute evidence. I see Ed Holmes '26, E. Kattwinkel '23, and John Strieder '22, all prominent Newton and Boston physicians, quite frequently. All three were a little behind us at the Institute. I have two nephews who are captains, both rather recent Technology graduates: one, in the Chemical Warfare Service, is recently back from the South Pacific; the other has been 'stuck' for the entire war at Dayton Field, working on the automatic pilot, and so forth. My own two youngsters, ages four and a half and nine years, regret that they were not in the service, so wear my old uniforms of the last war. The uniforms have not been cut down to fit. Art Kenison drops in at my house occasionally to see whether my insurance is in proper order."

Lou Grayson, a lieutenant colonel, living at the Westchester, Washington, D.C., writes as follows: "I'm still in the Army but hope to be promoted to civilian status in about three months. I'm in charge of 'military assistance' for the Army Air Forces. This includes insurance and a heterogeneous assortment of miscellany. I rather enjoy it; at present I'm making a comprehensive study of insurance for Army aviators. But I'll be glad to make a living again before long. I have a new boss now — just eight months old. We had planned to call her Alpha and the next one Omega but have decided to call her Alpha-Omega."

Louise (Peirce) Horwood of 8 Craigie Street, Cambridge, Mass., makes the following report: "This past summer I engaged in two activities which might be of interest to Technology Alumnae at least, if not to Alumni. I was a member of the committee appointed by Dr. Compton to redecorate and furnish the recently purchased residence for women students at 120 Bay State Road, Boston. We also worked on the organizational setup and secured a very competent housemother. The results to date seem very gratifying. The other activity was the running of a wedding in August for a young Chinese couple. The groom, Shao-Ti Hsu '43, is a graduate student in Mechanical Engineering, and his bride flew over the Hump from Chungking to Calcutta, thence by ship to the United States, to marry him. There were 125 guests at the wedding, including Mrs. Compton and many professors and their families. Chinese naval officers who were students at the Institute were among the ushers. The occasion was one of international friendliness and good will."

Bernard S. Coleman of 1706 Welton Street, Denver, Colo., has been appointed chairman of a committee on fact finding for the Denver Tuberculosis Society and also a consultant for the rehabilitation advisory service of the Colorado Tuberculosis Association. Richard S. Holmgren, 314 Union Building, San Diego, Calif., is still with the San Diego County Water Authority.

Harold F. Marshall has returned to his desk with Warren Webster and Company in Camden, N.J., after three and a half years of service with the Army Air Forces as an administrative officer at the headquarters of the Air Technical Service Command, Wright Field, Dayton, Ohio. Called to active duty from the Reserves as a captain on May 1, 1942, Marshall was promoted to the rank of major in January, 1943. One of the few administrative officers with a background comprising both industrial management and long contact with Army aviation, Marshall was assigned to

posts covering several phases of production and procurement of aircraft and related equipment. He organized the expediting of critical spares for aircraft, engines, and equipment from manufacturers. Later he co-ordinated the production and procurement of guided missiles. His last assignment was that of chief of the procurement plans branch of the communications sub-section. In this position he was responsible for the redetermination of air-borne radio and radar equipment requirements following V-E Day. Marshall was in one of the early groups of reserve military aviators, training in 1917 and serving as a first lieutenant and pilot at the front with the 88th Aero Squadron from June, 1918, until the Armistice. He participated in the fighting in six major offensives and was awarded the Silver Star. Before his entry on active duty in World War II, Marshall headed the Webster advertising department for 18 years, a position which he now resumes. In addition to his advertising duties, Marshall will be concerned with all the broader phases of the company's domestic and export sales developments. His home address is 103 Morgan Avenue, Palmyra, N.J. — EUGENE R. SMOLEY, *Secretary*, The Lummus Company, 420 Lexington Avenue, New York, N.Y. ALAN G. RICHARDS, *Assistant Secretary*, Dewey and Almy Chemical Company, 62 Whittemore Avenue, Cambridge 40, Mass.

1920

Your frustrated and disillusioned Secretary was heartened a bit by a swell letter from Phil Byrne, now back in New Jersey at 28 Canterbury Lane, Westfield, after a year in Washington with the Petroleum Administration for War and previous war years on the toluene, synthetic rubber, and aviation gasoline programs. Phil is still with the Standard Oil Development Company. Phil reports that at the New York Technology Club dinner for President Compton in December the Class was well represented. Al Glassett was at the head table, and among those present were Frank Bradley, Joe Givner, George des Marais, Don Mitsch, Bat Thresher, Jim McDonald, Eric Etherington, Chick Dana, and Don Dowling. Phil writes: "Your efforts to keep the Class together may appear thankless at times, but actually many of us who don't write often do actively follow The Review and the letters and greatly appreciate your news of the crowd." A few more letters like Phil's might convince me.

Our popular classmate, Ki Chun, has turned up safe and sound in Shanghai after four years, during which his children living in this country had heard nothing at all from their parents. A letter from Ki to his children says: "How happy we are now! Free again to live like normal beings, we have a lot to be thankful for. God has been good to us. Our home was taken away from us, but now the Japanese soldiers have left 400 Avenue Haig, and we expect to return any time. Things are very expensive. We have not gone back to our old monetary system yet. Rice went up to two million dollars for one hundred pounds, and now it has come down to one million dollars. Eggs are three thousand dollars each." Those of you who remember Ki and his warm and friendly personality will rejoice at this news.

Ed Burdell has received prominent mention in the New York papers for his statement that the problems of the returning veterans can be served best by the community through enlightened adult education centers. Ed is, of course, director of the Cooper Union.

Ernie Bangratz has returned to these parts from Pennsylvania and is living at 8 Wenham Road, Newton Highlands. C. E. Brown has left the Navy and is in Kansas City, at 7635 Holmes Road. Ed Cochrane, a vice-admiral, who was recently heard from in connection with the class gift, is stationed at Washington, Quarters C, 23rd and E Streets, Northwest. Henry Dooley, a commander, is now in Fort Lauderdale, Florida, at the Pelican Club Apartments. Chuck Eaton is now living in Cohasset on Stevens Lane. Henry Erickson is no longer in the Army, where he was a captain. His address is 3217 Connecticut Avenue, Northwest, Washington 8, D.C. Frank Maconi has left Belmont and is living in Framingham at 29 Arch Street.

We have received word that Jack Tunis died on September 17. He was living in Lexington, Ky. We have no further information about his untimely passing.

We hope soon to give you news of reunion plans. In the meantime, don't forget that there is a class gift in honor of our 25th anniversary and that Victory Bonds, Series *F*, made out to the "Massachusetts Institute of Technology, a corporation" should be mailed direct to Horace S. Ford, Treasurer, M.I.T., at Cambridge, with your name and address so that your gift may be properly identified. — HAROLD BUGBEE, *Secretary*, 7 Dartmouth Street, Winchester, Mass.

1921

As noted on other pages of The Review, the Institute will have two alumni observances this year. The first of these, on Saturday, February 23, will include Class Day exercises for the graduating class, at which Saint will represent us as the speaker for the 25-year Class. A banquet at the Statler that evening will conclude the alumni participation. On Saturday, June 8, the Institute will return to the usual program for Alumni Day, except in the choice of the day of the week and also in that there will be no graduating class at that time. The day will include a symposium in the morning, an outdoor luncheon, various social functions in the afternoon, and a banquet at the Statler to conclude the day. We hope as many of you will attend the February festivities as possible. Our own 25th reunion, however, will be held later in the year, and attendance then should be a *must* for all of you. Watch these columns and your mail notices for dates and program.

Death has come to three of our classmates. David Albert Newcomer, I, a colonel in the Armored Forces, was killed in action in southern France on August 25, 1944. An officer of the Regular Army, he was previously a member of the staff and faculty of the cavalry school at Fort Riley, Kansas. Carl William Starck, II, a first lieutenant, died in service on February 28, 1945. Edmund Irving Howard, XIII, a plant engineer with the New England Telephone Company, died on August 13. On behalf of the Class, sincere sympathy is extended to their families.

Richard Donovan, a major general, has been awarded the Distinguished Service Medal, and two brigadier generals, Herbert B. Loper, I, and Alfred B. Quinton, Jr., II, have been awarded the Legion of Merit. A summary of the military record of the Class now shows a total of 12 decorations, including three Distinguished Service Medals, eight awards of the Legion of Merit, and one Purple Heart. Two men have been killed in action, two died in service, and one each has been reported missing, wounded, and disabled in action. Your Assistant Secretary is co-operating with the Institute in maintaining military records for the forthcoming volume of Technology's war record, and any hitherto unpublished data will be most welcome.

Kenneth M. Moore, I, a colonel in the Corps of Engineers of the Regular Army, gently but firmly corrects our impression that he had returned to civilian life. Since the close of the war, Ken has been stationed in Duluth, Minn., where he is district engineer in charge of the United States Engineer Office. The principal responsibilities are the maintenance of the harbors on Lake Superior for the shipment of iron ore and grain and the receipt of coal. Ken had a long assignment during the entire war period in the United States Engineer Office at San Francisco, where he had charge of purchasing and shipping great quantities of Engineers' supplies and equipment for the Pacific theater of war and also of maintaining the rivers and harbors on the northern California Coast, including San Francisco Bay, so that shipping could proceed unhampered.

Jackson W. Kendall, XV, sent greetings via a "Kendall Kalendar" which charts, in graphic form, the travels of the family since 1943, when they left Pasadena and drove to Richmond, Va., where Jack was stationed at antiaircraft division headquarters as a lieutenant colonel. In 1944, Jack was transferred to the Antiaircraft Artillery Training Center at Camp Edwards, Mass. Marge, Jack, Jr., and Robert drove up from Virginia and summered at Falmouth, until the training center closed and Jack's active duty terminated. This "drivingest" family then returned to Pasadena via eastern Canada and the Santa Fé trail. Shortly after their return, Jack's old firm, Bekins Van Lines, opened a new office in Salt Lake City with Jack as manager, and the family pulled up stakes again after selling the Pasadena home. They now live at 676 South 12th East Street, Salt Lake City 2, Utah, but to judge by Jack's itinerary of recent travels, you may find them moving in next door as you read this.

Dugald C. Jackson, Jr., VI-A, also brings his record up to date with holiday greetings that include the announcement of a transfer from four years of duty at the Frankford Arsenal to the Aberdeen Proving Ground, Md. Dugie is a lieutenant colonel of Ordnance. Pending the completion of the school year, the family will remain in Philadelphia at a new home, 1038 Bridge Street, Philadelphia 24, near the high school at which Betsy and Dan are seniors. Elisabeth and Dugie became grandparents for the second time on the arrival of the second son to Dugald III, a lieutenant at the Portsmouth Navy Yard. David has become a full lieutenant in the Navy and has

returned from Hawaii to an assignment at naval architecture school at Ann Arbor.

Many other fine holiday greetings have been received, and we want to thank you all for remembering. Among them are an original from the St. Laurents, a friendly reminder from Michiganders Marie, Stuie, Peggy, and John Nixon, an unusual Japanese print from Harold O. Bixby, a colonel with the Signal Corps on Hokkaido, and a homey scene depicting the Don McGuires with daughter Janice on the front steps of their Middletown, N.Y., home, greeting the return of their son, Sergeant Don, Jr.

Howard L. Vickery, XIII-A, a vice-admiral, has submitted to President Truman his resignation as vice-chairman of the United States Maritime Commission. Lee J. Purnell, VI, has been made professor and head of the electrical engineering department of Howard University, Washington, D.C. We recently had lunch with George Chutter, VI-A, of the Hevi Duty Electric Company, who reports a considerable addition to their line of high-temperature and related equipment for heat treating, surface hardening, and general uses.

Among those present at the 15th anniversary dinner for Dr. Compton, sponsored by the Technology Club of New York, were the following: Mr. and Mrs. A. Warren Norton, Mr. and Mrs. Alexander D. Harvey, Mr. and Mrs. Irving D. Jakobson, Mr. and Mrs. George S. Piroumoff, Mr. and Mrs. R. C. Lockwood, Mr. and Mrs. William R. Hainsworth, and George Chutter.

Don't wait for Dan to ride herd on you to get the crowd out from your area for the reunion. Start on your own now to telephone, write, or wire the locals. — Raymond A. St. Laurent, *Secretary*, Rogers Corporation, Manchester, Conn. Carole A. Clarke, *Assistant Secretary*, International Standard Electric Corporation, 67 Broad Street, New York 4, N.Y.

1922

A good cross section of the alumni activities of our Class is given by some data compiled by Yard Chittick. We have five members on the Alumni Council, two members on the departmental Visiting Committee, six officers of local alumni clubs geographically spread out from Buenos Aires to Oslo, and 17 honorary secretaries covering the map from Zürich, Switzerland, to Bogotá, Colombia.

Undoubtedly a large number of our Class performed important work in connection with the atomic bomb project. In reading the Smyth report, the name of Crawford H. Greenewalt of Du Pont appears several times as a member of a small committee in which was vested the responsibility for establishing the major policy of a very vital part of the project. There may have been other names which we did not recognize on glancing through the report, and we saw several names of men who were in neighboring classes.

The winter Alumni Banquet is to be held in Boston on February 23, and we hope that it will result in a gathering of the Class in the good old-fashioned manner.

In the last issue we mentioned that Chuck Brokaw is back at 1 South Downing Street, Denver, Colo. Since then we have had an interesting letter from Chuck in which the high points are as follows: (1) When it comes to cutting red tape and getting things done, Brigadier General Al Browning in Washington is the man to do it. (2) The Germans were a more formidable military opponent than the Japanese, but the nature of the terrain and fighting conditions made the war in the Pacific more hellish than in Europe. (3) The closing campaign on Mindanao was a marvel of logistics. The Japanese were taken by surprise from the rear. To accomplish this, our forces crossed 125 miles of supposedly impassable river and jungle territory in 10 days and hit the Japs while their guns were still pointing in the opposite direction. Chuck paid splendid tribute to the C-47 flying boxcar but admits that there were times when the most important job was to winch a carabao out of the mud so that the supplies could continue to move forward.

These notes are being written just before Christmas, and accordingly we extend to you all on behalf of the officers the wish for a happy and prosperous New Year. — Clayton D. Grover, *Secretary*, Whitehead Metal Products Company, Inc., 303 West Tenth Street, New York, N.Y. Whitworth Ferguson, *Assistant Secretary*, 333 Ellicott Street, Buffalo 3, N.Y.

1923

Our 25th reunion will be held in 1948. Because of the relatively leisurely pace at which class affairs must be handled, will you be thinking about our observance of it? Don't say you weren't warned.

Thanks to Professor Locke '96, I have the following item: Gilbert Whitehead is now superintendent of mines and construction at the department of the Compañía Vale do Rio Doce, Presidente Vargas, Minas Geraes, Brazil. The company is developing the well-known Itabira iron ore deposits and installing a modern mining plant with an annual capacity of 1,500,000 tons and rehabilitating the 300-mile railroad extending from the mine to the port of Victoria. This work includes approximately 100 miles of new railroad construction.

I also have from the War Department in November the following copy of the citation accompanying the award of the Distinguished Service Medal presented to General Christmas by Lieutenant General Levin H. Campbell, Chief of Ordnance: "Brigadier General John K. Christmas rendered outstanding service in a duty of great responsibility as Chief, Tank Division, Office of the Chief of Ordnance; as Assistant Chief and Chief Engineer; and as Chief of Field Service Operations of the Tank-Automotive Center (later Office, Chief of Ordnance-Detroit) of the Ordnance Department, Army Service Forces, from June, 1942, to October, 1944. He contributed to and had a major interest in the design and production of the General Sherman Medium Tank M4 and numerous other combat vehicles. The accomplishment of Ordnance supply procedures relating to vehicles, and the institution of a comprehensive master depot plan to expedite overseas shipments were attributable in large measure to the initiative, inventiveness, and outstanding leadership of General Christmas."

Governor Tobin of Massachusetts in November submitted to the governor's council several nominations for appointments which included the name of Lawrence E. Duane of Beverly as a master in chancery.

I have some news from E. Fletcher Ingals, who writes as follows: "Up until the first of April of this year, I had been district airport engineer for the Civil Aeronautics Administration with the six New England States as my territory and an office in the Custom House, Boston. In April, however, I was transferred to the C.A.A. Regional Office at 385 Madison Avenue, New York City, to assume the duties of assistant supervisor of airports, and I now cover the District of Columbia and 13 states extending from Maine to Virginia. My big problem in making this change was in locating a place to live. Places for rent were practically nonexistent, and I finally ended by purchasing an old place out in the country, where I have an opportunity to dress and do as I please without shocking the neighbors. After struggling all summer to get carpenters, plumbers, painters, and so on, to make the necessary repairs on the house, I finally moved my family down from Wellesley at the end of September. With our son just out of service after flying three years for the Navy, I feel as though we are really living again. Fletcher, Jr., expects to enter Technology in the fall of 1946 — there are too many on the waiting list for him to get in now." The country address to which Ingals alludes is Riversville Road, Route No. 4, Greenwich, Conn.

Eight members of the Class, two of them with their wives, attended the testimonial dinner to President Compton given by the New York Technology Club at the Biltmore on December 5. Howard Russell, who was present, sent me the list, which included W. E. R. Covell, Louis H. Skidmore, Harold I. Beadle, Theodore M. Edison (with Mrs. Edison), Hubert L. Williams, Francis T. Willis, Dr. Joseph L. Hetzel (with Mrs. Hetzel). Mrs. Hetzel (Margaret de Lancey) is the daughter of two Technology graduates, Darragh de Lancey '90 and Harriet Gallup de Lancey '94. — Horatio L. Bond, *Secretary*, 457 Washington Street, Braintree 84, Mass. Howard F. Russell, *Assistant Secretary*, Improved Risk Mutuals, 60 John Street, New York 7, N.Y.

1924

Back from the European theater with five battle stars, the Purple Heart, and the Bronze Star, John B. Gegan, a lieutenant colonel, has returned to his former job as division commercial engineer for the New England Telephone and Telegraph Company in Providence, R.I. John had seen action in France, Luxembourg, Belgium, Germany, and Czechoslovakia, his last assignment having been at General Patton's headquarters in Bavaria. Two other members of the Class, also in the telephone business, are now operating Boston's telephone service, Gene Cronin as district manager and Gordon Joyce as district traffic supervisor.

Perry Maynard, who before going on active duty in the Signal Corps was Detroit district traffic superintendent for the American Telephone and Telegraph Company, was recently promoted to the rank of colonel. Bill Correale, a major, was recently awarded the Bronze Star for his work

in the European theater. The latest word of Cliff Bailey, a lieutenant colonel in an antiaircraft gun battalion, is an A.P.O. number in San Francisco, and we haven't heard whether he has yet returned. Herbert Loring had "major" prefixed to his name during the summer, and Charles F. Lyman, Jr., a lieutenant commander, substituted a Marblehead, Mass., address for an F.P.O. in San Francisco.

Wink Quarles, back with McGraw-Hill after his Army service, is also secretary of the Technology Club of New York and took an active part in the dinner sponsored by the Club in December in honor of Dr. Compton. Among those long-not-heard-from by the Secretary is Tom Johnson, who for some time has been superintendent of the Welsh Manufacturing Company in Providence. A note from Charlie Locke '96 discloses plans for a special Alumni observance on June 8 at the Institute, with all the pre-war features. There is a suggestion, which sounds good, that classes which had to postpone their 1944 reunions might tie in with the June 8 date. Our people should all be back from the service then, and a big reunion should be possible. Will *you* write and tell the Secretary what you think of the idea? — FRANCIS A. BARRETT, *General Secretary*, 234 Washington Street, Providence, R.I.

1926

Three of the '26 men who have been in the service and who have been residents of Wellesley are now back — Bob Dean, Ken Billings, and most recently Elton Staples. All served in the European theater and with distinguished records.

The following article appeared in the *National Petroleum News* last August 15, limning the accomplishments of our distinguished Class President: "David Allan Shepard is likely to do more to maintain industrial amity between the United States and the British Empire than almost any other man representing American industry abroad, in the opinion of his friends in petroleum circles.

" 'Dave' Shepard was appointed chairman of the board of directors of The Anglo-American Oil Co., Ltd., subsidiary of Standard Oil Co. (N.J.), only two and a half months ago. Yet his experience in Britain and on the Continent dates back more than a decade, and he is regarded as one of the best informed American oil men working outside home territory.

"Born in Denver, Col., in 1903, Mr. Shepard was graduated with a chemical engineering degree from . . . Technology, and joined Standard Oil of New Jersey in 1927. For more than two years he worked at the Baton Rouge refinery of Standard of Louisiana as a research engineer in connection with hydrogenation, product specification and product application problems. In 1934 Mr. Shepard was transferred to Paris, and he shuttled between that capital and London for the next six years. In 1940 he returned to the United States, became Jersey Standard's technical adviser on foreign markets, and remained in New York until mid-1942, when he resigned to become petroleum attaché to the U.S. Embassy in London. He rejoined the Jersey Standard affiliate in September, 1943, and last June was elected chairman of Anglo-American, one of the world's largest distributors of petroleum products outside the United States. He succeeded E. E. Soubry, now in a New York post in charge of foreign marketing for Jersey Standard.

"Mr. Shepard is 6' 8" with his shoes on — an inch and a half less without them. He is an all-round athlete, and particularly likes squash and swimming. He is married and has two children. He lives in Cheam, Surrey, a suburb of London. As one of his associates put it: 'He has extraordinary ability to keep British and American minds thinking alike.'

"Somewhat the same thought was expressed by The Petroleum Times of London, on the announcement of his appointment as chairman of Anglo-American. Of 'Dave' Shepard, the British publication said: 'It is no secret that his common-sense, tact and intimate knowledge of British methods eased or solved many a situation that in less capable hands might have led to irritation. To Mr. Shepard lies the credit in no small measure for the harmonious relationships between Britain and the United States in matters of wartime oil supply and problems.' " — We are indeed proud of Dave's distinguished record and present post.

Dick Plummer, recently numbered among our South American contingent, continues in Washington; his present address is 2625 O Street, Northwest. — Dick Sherman reports that he is with the Navy Department at 90 Church Street, New York City. His position is that of superintending civil engineer and office engineer and manager for Areas I and II. — Whitney Ashbridge, about whom we reported last month, now has a Philadelphia address, 10 East Abington Avenue. — Samuel Bloom, formerly senior research engineer with the Pennsylvania department of highways in Harrisburg, is now a chemist with the Titanium Pigment Corporation in New York City. — Cecil A. P. Thomas, an Army major until last November, is assistant manager of the Gilbert and Barker Manufacturing Company in West Springfield, Mass. — Dwight Taylor has moved to Chicago, where he is now plant superintendent for the Connelly Iron Sponge and Governor Company. Before the Chicago move he had been in Virginia with Calco Chemical at their Piney River works. — JAMES R. KILLIAN, JR., *General Secretary*, Room 3-208, M.I.T., Cambridge 39, Mass.

1927

We regret to inform you of the death of two of our classmates. Dexter K. Coolidge died on May 30 at Waynesboro, Va. No details are available except that he had been employed in the acetate division of the Du Pont Company.

Lyman B. Johnson died on August 25 at the Cleveland Clinic Hospital after a brief illness. Mr. Johnson was a son of William and Maud (Wright) Johnson, born March 13, 1905, in Dorchester, Mass., where he lived until his graduation from Technology. He remained at the Institute for several years as an instructor in the Physics Department. In 1930 he married Helen B. Davis of East Jaffrey, N.H. Since 1934, Mr. Johnson had been in industrial engineering, development, and research, starting with the Hygrade Sylvania Company, but after 1935 continuing with the General Electric Company, where he had worked on the fundamental characteristics of electric discharge lamps of the high-pressure mercury types of recent prominence in specialized lighting fields. He had published papers on some of his work, and the General Electric Company has many patents, issued or pending, on principles and processes that he developed. In recent years, Mr. Johnson had made notable contributions to the war work of the Nela Park Lamp Development and Research Laboratories on radar devices, fluorescent lamps, and high power lamps for aerial photography. Surviving him are his wife; a daughter, Virginia; and his parents.

H. A. Moineau writes interestingly of his recent activities as follows: "I was called to active duty as a lieutenant in the Ordnance Department in April of 1942 and was at Aberdeen Proving Ground until the latter part of September in that year. The branch to which I was attached was then moved to Detroit, where I was assigned to the development division of the office of the Chief of Ordnance in Detroit until my return to inactive status on October 12 of this year. To complete the record — I received one promotion during my tour of active duty, receiving my captaincy on May 1, 1943. I have now returned to my former home in Marlboro, and have resumed my former occupation with the Marlboro Wire Goods Company. I think most of the boys know that this is a family affair in which my father and I possess the controlling interest. I always read very carefully all the '27 class notes in The Review, but, I must confess I have not before been a contributor to them. I hope to be able to attend the next alumni meeting and renew contacts with old friends."

Our Canadian department comes up with the following from Armand E. Bourbeau: "Herewith a few lines to let you know that I have been released from the Royal Canadian Air Force, after five years of service as engineer in charge of building construction and maintenance in eastern Canada. I am now assistant director in charge of training for the Montreal Building Apprenticeship Commission. This apprenticeship center has been in operation since the 5th of November, and the work is most interesting. Courses of instruction are in both French and English and cover most of the trades in building construction. I should like very much to hear about Patterson, Lyons, Brucker, and Huang and should be very glad to meet my friends of IV-2 when they come to Montreal. My address is 2275 Laurier Avenue East; and my telephone number, Falkirk 1124."

The following article, which deals with the present activities of T. A. Knowles, is quoted from *American Aviation Daily* of December 15: "The possibilities and potentialities of the airship in both passenger and cargo trans-oceanic operations were explained to the Congressional Flying Club of Washington last night by T. A. Knowles, vice president of Goodyear Aircraft Corporation. Using the characteristics of a modern 10,000 cu. ft. rigid airship 950 ft. long, 142 ft. in diameter, 6,300 hp, top speed of 90 mph and range of 7,000 mi., as the basis for comparison, Knowles said this ship could be operated at ½ to ⅓ of the estimated cost of the flying boat. Estimating the cost of four such airships at $30,000,000 and a like price for 20 flying boats, Knowles

said the airships could carry 90 tons each to 18½ tons each for the flying boats on a 2,500 mile flight at a fleet operating cost of $246,400 a week compared to $480,000 for the flying boats, or 9½¢ a ton mile for the airships compared with 16.2¢ a ton mile for the flying boats. On a 4,000 mile flight, the differential in ton mile costs would be greater — 12.2¢ to 31.6¢ — in favor of the airship, Knowles said. De luxe accommodations for 112 passengers could be provided between San Francisco and Honolulu for $215 or between New York and London for $415 with Pullman type accommodations for 232 passengers at a typical one-way fare of $105 and $200 respectively between the above named pairs of cities, Knowles declared. 'Our studies indicate that the first ship could be placed in service 24 months after start of detail design. Successive ships could follow at six months intervals. The estimated cost is indicated in the neighborhood of $8,000,000 per ship produced in reasonable quantities,' Knowles said."

The Alumni Association has asked that we call your attention through this column to a special Alumni observance on Saturday, June 8, at Technology. There will be a symposium in the forenoon, a grand open-air luncheon, special features in the afternoon, and a large banquet at the Hotel Statler in the evening. Let's plan to meet there. — Joseph S. Harris, *General Secretary*, Shell Oil Company, Inc., 50 West 50th Street, New York, N.Y.

1930

The new year will find many of our classmates returning to their old jobs or to new ones after several years of duty in the armed services. To these men and to others still in uniform, the Class extends its gratitude for jobs well done! We regret that a few of our classmates cannot return, and to their families our sympathy is offered. Word has just been received from his wife that Ulysses Peoples, Jr., a lieutenant colonel, lost his life in December, 1944, aboard a prison ship. Our sympathy is also extended to John Schroeter in connection with the tragic death of his wife. John is assistant manager of Pan American Airways' Africa-Orient division.

Bill Driscoll has rejoined the Harvey Steel organization after service as a lieutenant on the staff of the supervisor of shipbuilding at Quincy, Mass. Tul Houston is again in charge of the industrial real estate firm bearing his name in Newark, after three years of duty with the Army Engineers. After a similar length of time in the Navy, Harlan Thompson is now a civilian. Before the war he was resident manager of the Pioneer Placer Mining Company in Gold Creek, Mont. We are pleased to report Legion of Merit awards to John Kenyon and Wayne Hertzka, both lieutenant colonels in the Army, in recognition of outstanding service abroad. The Tokyo Technology Club will have as a new member Warren Martell, also a lieutenant colonel, who is to be engaged in special work there. John Worcester is the new general manager of the Compañía Minera y Agricola Oploca de Bolivia with headquarters in Chocaya, Bolivia. Congartulations to Dave Landen, who was recently married to Jeanne Lesnick of Washington, D.C. Dave is with the United States Geological Survey, where aerial surveys are his specialty.

Our Class President is the happy father of a new daughter, Joan, born last May. The Bennetts visited the home state of Vermont in October, spent a day at the Institute, and saw the Holts and Riehls in New Jersey en route back to Ohio, where Jack is working with Goodyear Aircraft at Akron. Jack reports that the Rowzees are enjoying their stay in Sarnia, Ontario, where Fluque is in charge of Canada's synthetic rubber program.

We are looking forward to seeing a large turnout of 1930 men at the Alumni Day celebration on February 23 in Boston. Plan to be there to meet the bunch you've missed seeing during the war years. If you can't make it, send a line to your Secretary, who will pass the word along. — Parker H. Starratt, *General Secretary*, 1 Bradley Park Drive, Hingham, Mass.

1940

The following engagements have been announced: Herbert C. Wohlers to Helen Davis, Hans Otto to Virginia Hegeman, and Richard E. Herr, a lieutenant commander, to Jeannette Kutschko. Those recently married are as follows: L. Hurley Bloom, a lieutenant commander, to Mary Louise Tolan and Charles Edo Kip to Elva May Brain. Frank and Sophia Libman have announced the birth of a son named David Frank on October 13.

Tom Creamer received word from George A. d'Hemecourt, Jr., formerly an aviation cadet in the Army. When heard from, he was working for General Electric on fire control systems for B-29's and B-36's. — H. Garrett Wright, *General Secretary*, Garrett Construction Company, 510 Sherman Avenue, Springfield, Mo. *Assistant Secretaries:* Thomas F. Creamer, 2032 Belmont Road, Northwest, Washington, D.C.; John L. Danforth, Room 24-222, M.I.T., Cambridge 39, Mass.

1941

Much of this column has been taken up during the war in listing entries into the service and promotions. It is quite natural that demobilization fill a corresponding portion of our news during the coming months. The items appearing should take on more significance, for the new locations are likely to be of a more permanent nature, in so far as members of the Class are concerned. If you feel some interest in the location of your classmates, drop us a line with some news about yourself — the rest will come automatically.

Among those who have dropped the military or naval prefix are Ed Sherburne, Irv Koss, and Walt Hudson, all Army captains, Al Hartman, a Navy lieutenant, Kenneth Spengler, a lieutenant colonel, and Bob Montana, a Navy lieutenant. Ken Spengler received his commission in the Air Corps in the spring of 1941 and served as climatological and verification officer and assistant base weather officer at Bolling Field until January, 1942, when he became executive officer of the Army Air Forces Weather Central in Washington. He later served successively as chief of the climatological and statistics section of the A.A.F. Weather Directorate and chief of the verification section of the Weather Information Branch. He served for two years as chief of the forecast branch of the weather division at A.A.F. headquarters in Washington before being transferred recently with the A.A.F. Weather Service Headquarters to Asheville, N.C., as executive officer of the evaluation and development division there.

The train from Boston to Philadelphia at the end of the Christmas holidays served as a good place to meet '41 men; for example, Butch Berman and Bob Alfred on terminal leave going to their experimental foundry in Brooklyn, where they are working with Les Gott, also an ex-captain from Uncle Sam's Army. Lieutenant Staros of the Navy Department Bureau of Aeronautics in Washington, Captain Hasert of the Army Air Forces, and Lieutenant Edmunds '42 were there as well. Hasert is with the scientific advisory group at the headquarters of the Army Air Forces, and tells of one Major Walkowicz of the same outfit. Ted has just completed a tour around the world by plane on a technical mission of sorts. He picked up the Legion of Merit along the way. Hasert has recently returned from a similar tour through the European theater of operations. Ted tells of a meeting of the Technology Club of Shanghai. As far as is known, Fernandez, Abzug, and Gavin are still with the Bureau of Aeronautics in Washington. I received a card from Joe the other day with no indication as to when he'll get out. Marion Walsh is now the wife of Erling Hustvedt, a lieutenant in the Naval Reserve.

Hank Avery received his majority recently and is now serving under General Clark with the occupational forces in Austria. Hank participated in the invasions of Oran, North Africa, and Salerno, Italy. He has been overseas since August, 1942. Jim Thornton, a major, is now assigned to the research and plans section of the Military Government in Seoul, Korea. J. L. Klein, since September, 1944, has been a research metallurgist, head of the research department at the Jessop Steel Corporation in Washington, Pa. A card from Ivor Collins states that he has recently returned from the Pacific after two months in Japan and is now on terminal leave. Warren Meyers, a lieutenant, is still terminating at Thomas A. Edison Company, West Orange, N.J. A publication from Princeton University tells us that Robert Anderson has been awarded the Standard Brands fellowship in organic chemistry at Princeton. — Stanley Backer, *General Secretary*, Philadelphia Quartermaster Depot, 2800 South 20th Street, Philadelphia 45, Pa. Johan M. Andersen, *Assistant Secretary*, Saddle Hill Farm, Hopkinton, Mass.

Remember the date — February 23 — Annual Alumni Banquet and Class Day Exercises

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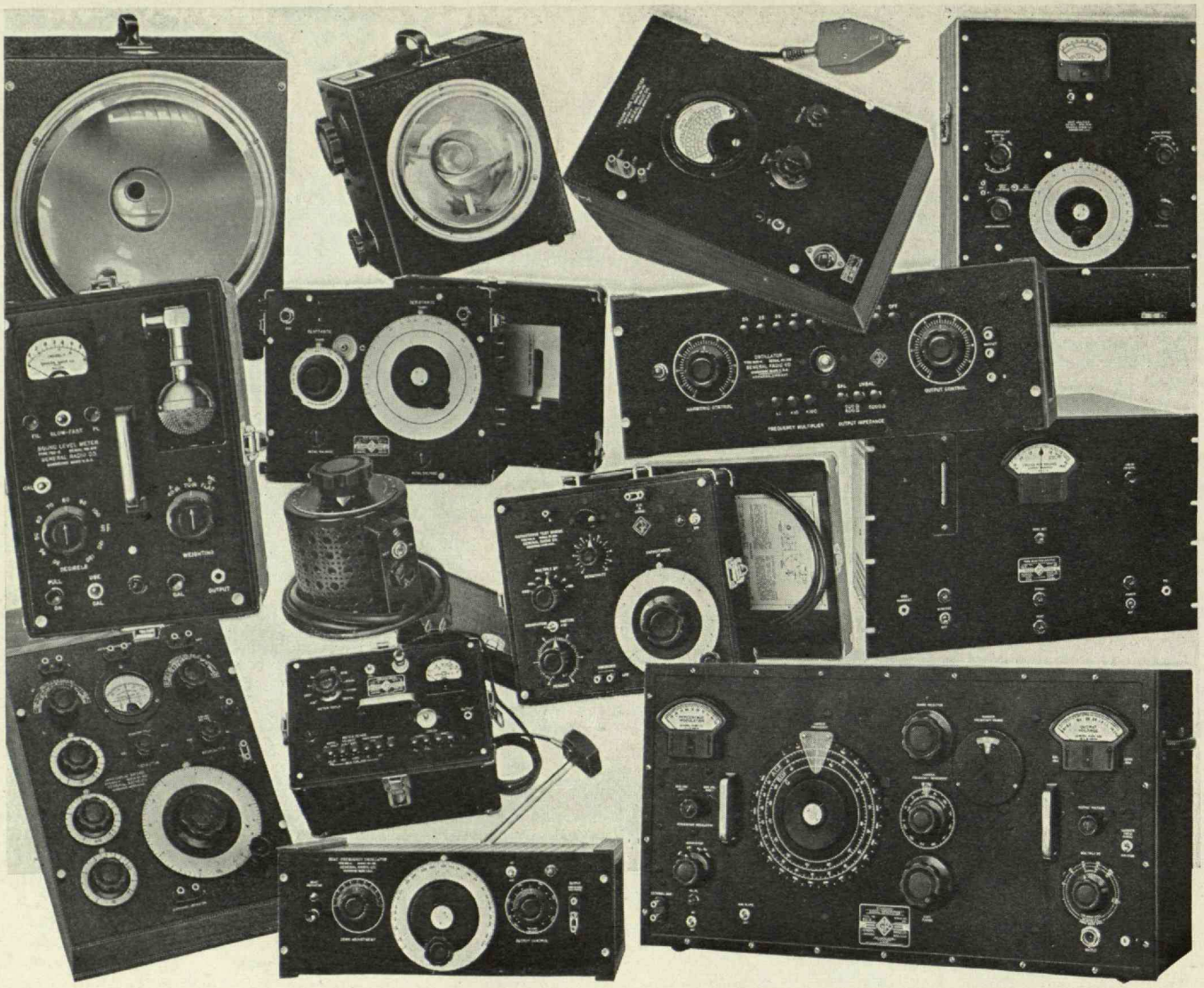
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IN ANY LABORATORY...

It is difficult to picture any modern scientific or industrial laboratory that does not have need for *some* G-R instrument. The considerable impetus given to electronic research during the war has greatly expanded the need for G-R equipment.

Since it was founded in 1915, General Radio has developed, manufactured and supplied industry with an increasingly large number of instruments for audio- and radio-frequency measurements, until at the present time the complete line of G-R equipment and accessories is numbered in the hundreds of models.

General Radio instruments include:

INDUSTRIAL INSTRUMENTS: Stroboscopes, Sound and Vibration Meters and Analyzers, D-C Amplifier, Variac Continuously-adjustable Transformers

WAVEFORM INSTRUMENTS: Wave Analyzer, Modulation Meter, Distortion Meter, Wave Filters, Oscillograph Recorder

FREQUENCY MEASURING EQUIPMENT: Primary and Secondary Standards of Frequency, Interpolation Equipment, Heterodyne Frequency Meters, Frequency Monitors, Wavemeters

BRIDGES for measuring: Capacitance, Power Factor, Inductance, Resistance, Vacuum-tube Characteristics

RESISTANCE: Standards, Decade Resistors, Resistance Units, Attenuators, Rheostat-potentiometers

CAPACITANCE: Air and Mica Standards, General-Purpose Fixed and Variable Condensers

INDUCTANCE: Standards and Variable Inductors

STANDARD-SIGNAL GENERATORS

OSCILLATORS: Electronic Audio- and Radio-frequency, Pulse Generator, Tuning Forks

METERS: Vacuum-tube and Rectifier-type Voltmeters, Micro volter, Megohmmeters, Oxide Rectifiers

PARTS AND ACCESSORIES: Switches, Dials and Knobs, Plugs and Jacks, R-F Chokes

Before you buy any electronic laboratory measuring equipment, it will pay you to investigate the G-R line.

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